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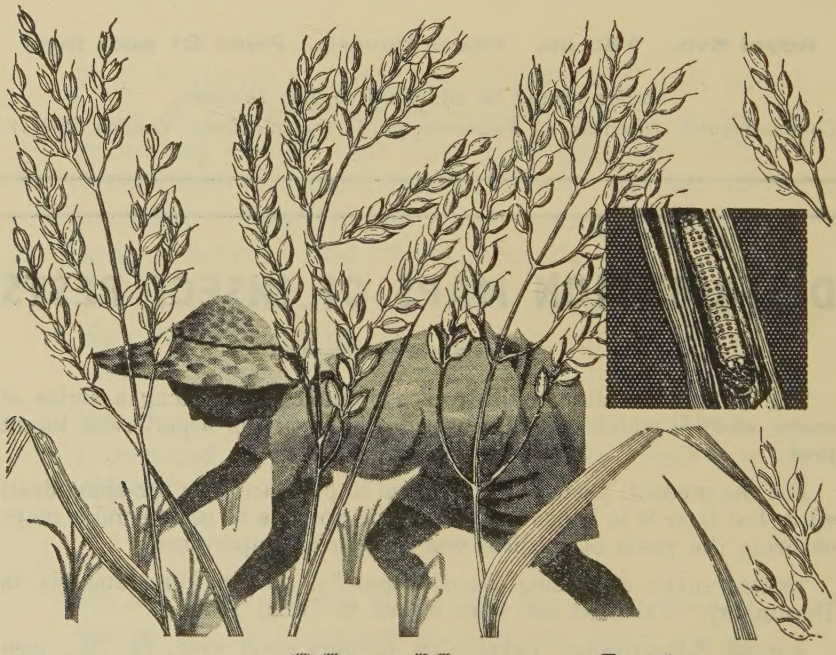

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NISHIDA (T.) & HOLDAWAY (F. G.). **The Erinose Mite of Lychee.**—*Circ. Hawaii agric. Exp. Sta.* no. 48, 10 pp., 5 figs., 7 refs. Honolulu, 1955.

Aceria (*Eriophyes*) *litchii* (Keifer) is an important pest of litchee (*Litchi chinensis*) in Hawaii, causing the development of galls on the upper surfaces and a thick felt-like growth on the lower surfaces of the young leaflets [*cf. R.A.E.*, A **33** 111] and a general curling of the foliage. Little is known of the life-history of the mite, but it appears to be specific to litchee. Observations showed that infestation was commonest between November and May, when the trees are producing new growth, and that effective control was given by spraying with wettable sulphur at 5 lb. per 100 U.S. gals. water five times a year, at monthly intervals, beginning when the new shoots had begun to emerge.

MEIER (W.). **Über** *Myzus varians* **Davidson und einige weitere** *Myzus*-**Arten aus der Schweiz (Hemipt. Aphid.).** [*M. varians* and some further Species of *Myzus* from Switzerland.]—*Mitt. schweiz. ent. Ges.* **27** pt. 4 pp. 321–409, 35 figs., 58 refs. Berne, 1954.

Myzus persicae (Sulz.) is the most important insect vector of potato viruses in Switzerland. Observations on its flight periods are therefore undertaken, but it is difficult to distinguish from *M. varians* Davidson on peach and from *M. ascalonicus* Doncaster, *M. certus* (Wlk.) (of which *M. caryophyllacearum* H.R.L. [*cf. R.A.E.*, A **34** 367] is a synonym), *M. ajugae* Schout. and *M. myosotidis* (Börn.) in trap catches; the last three of these Aphids are recorded from Switzerland for the first time. To facilitate identification, the author gives keys to the apterous and alate viviparae of all six species, compares their characters in a table, reviews their synonymy and distribution, describes their various forms, and gives information on their food-plants and bionomics. Notes are also given on the distribution and food-plants of three other species of *Myzus* (*M. ornatus* Laing, *M. lythri* (Schrank) and *M. cerasi* (F.)) that occur in Switzerland.

M. varians [*cf.* **29** 45] was first observed in Switzerland in 1947. It occurs in the Ticino and the district of Lausanne, and lays winter eggs on peach. Fundatrices and young were observed in April feeding on the opening leaf buds, so that the winter eggs had probably hatched in March. Alates developed in the laboratory in the second generation of fundatrigeniae, and they formed 84 per cent. of the third generation. Almost all the examples found on peach in the field in mid-June were alates. *Clematis vitalba* was readily colonised in the laboratory, and apterae were found on *Clematis* in the open in late June. Small groups of apterae were present in rolled leaves on peach throughout the summer and autumn and were heavily attacked by Coccinellids and Syrphid larvae, though ants afforded some protection against these predators. In the laboratory, these colonies gave rise to oviparae and males in November, at the same time as did the migrant line from *C. vitalba*, and winter eggs were laid. No overwintering occurred on species of *Prunus* other than peach. Observations on the effect of temperature on the development of the Aphid and the conditions under which flight occurs are recorded.

Investigations on the migration of Aphids were made in potato fields in numerous localities at altitudes of up to about 4,000 ft. in central and northern Switzerland in 1952 and 1953, by means of counts on the plants and the use of yellow trap-dishes set up in the fields. In a preliminary test, round dishes almost 10 ins. in diameter were compared with rectangular dishes some 20 ins. long and 13 ins. broad, and comparison of the catches per unit area of dish bottom showed that the round dishes were generally superior to the rectangular ones when few Aphids were on the wing and

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that there was little difference when the flight was heavy. The results of the counts in the two years are discussed in some detail and illustrated on graphs for selected localities. The species found on the plants were *M. persicae*, *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.), *M.* (*Aulacorthum*) *solani* (Kalt.) and *Aphis nasturtii* Kalt., and it is concluded that infestation by *Myzus persicae* is to be expected in favourable districts from mid-May and in more exposed ones from mid-June. Summer migrants and the main virus spread do not occur until the end of June or the beginning of July, with a delay of only a few days at 2,500 ft. and scarcely more than a week at higher altitudes, where infestation is generally lighter. On the basis of the results obtained, recommendations are made as to suitable districts for the raising of virus-free stocks of seed potatoes.

Heintz (E.). **Des répulsifs nouveaux: les répulsifs spécifiques. Expériences sur l'abeille et le doryphore.**—*Phytiat.-Phytopharm.* **4** no. 1 pp. 45–54, 7 figs., 9 refs. Paris, 1955.

The author has investigated in France the repellent effects on a wide range of animals of the crushed bodies or parts of bodies of individuals of their own species. The insects tested in the laboratory included *Drosophila melanogaster* Mg., *Leptinotarsa decemlineata* (Say), *Locusta migratoria* (L.), honey bees and larvae of *Tenebrio molitor* L., and all were repelled by crushed examples of their own species when enclosed with them in special chambers, the degree of repulsion being proportionate to the amount of crushed material provided. In a test with honey bees, groups of 16 individuals were placed in glass containers, with a capacity of about 250 cc., alone or with the dry powdered bodies of 4–10 bees. Those confined alone died in a little over five hours, those confined with the remains of four bees died in a little over four hours and those confined with the remains of 6–10 bees died in about two hours. Similar results were obtained with *Formica rufa* L. and larvae of *T. molitor*. None of the test insects died when confined with the powdered remains of species other than their own, and mortality was therefore not due to blocking of the tracheae by dust particles. Further studies showed that in honey bees, the repellent substance was localised in the muscles, about 60 per cent. of it in the muscles of the thorax and about 30 per cent. in those of the legs.

In 1954, a field test was carried out on rape in flower, the pulverised bodies of 30 bees being scattered over a plot nearly 12 sq. yards in area. The number of bees visiting the treated plot was reduced, almost immediately, by about 25 per cent., and the reduction was increased to 52 and 80 per cent., respectively, by using 60 and 90 bees per plot. Heavy rain followed after three days, and the percentage reduction was decreased from 80 to 18. It was noted that most of the powder settled on the lower leaves and the ground. In a further test, 35–40 per cent. of the adults of *L. decemlineata* left potato plants within 24 hours when the leaves were dusted with pulverised adults, and the repellent effect lasted for 23 days, in spite of heavy rain, when an adhesive powder was added to the dust. When 25 adults were caged in the field with two potato plants, one of which had been heavily dusted with pulverised beetles, 20 left the treated plant within 24 hours and had not returned by the end of a week.

Nirula (K. K.), Radha (K.) & Menon (K. P. V.). **The Green Muscardine Disease of *Oryctes rhinoceros* L. I. Symptomatology, Epizootology and economic Importance.**—*Indian Cocon. J.* **9** no. 1 pp. 3–10, 8 figs., 17 refs. Ernakulam, 1955.

The fungus, *Metarrhizium anisopliae*, has long been known to attack *Oryctes rhinoceros* (L.) in various parts of the world, and attempts have

been made to disseminate it artificially for control of the beetle on coconut [*cf. R.A.E.*, A **11** 299; **28** 206; **30** 215, etc.], but conclusive results have not been obtained. In this first part of a series, the authors describe the symptoms caused by it in the larvae, pupae and adults of the Dynastid from observations at Kayangulam, in south-western India, where it has occurred sporadically in coconut gardens since March 1954. The fungus appears to be present in the breeding material of *O. rhinoceros* throughout the year there, but infestation of the insects is highest between May and August, during the south-west monsoon, when humidity is consistently high. In 1955, when rainfall during this period amounted to 72·4 ins., the mean maximum and minimum temperatures were 86·2 and 74·6°F., respectively, and the relative humidity ranged from 71 to 93 per cent., natural infestation rose to 32 per cent. among larvae in June, 16 per cent. among pupae in July and 55 per cent. among adults in August. The fungus was commonest in farmyard manure. It is probably more effective in controlling *O. rhinoceros* than is apparent, because infested larvae and adults leave the breeding material shortly before death, and may then be destroyed by predators, and infested pupae disintegrate in the soil. Activity by *O. rhinoceros* is at a minimum during August–October, immediately after the period of high infestation by the fungus.

Puttarudriah (M.) & Lakshminarayana Bhatta (K.). **A preliminary Note on Studies of Mysore Plants as Sources of Insecticides.**—*Indian J. Ent.* **17** pt. 2 pp. 165–174, 8 refs. New Delhi, 1955.

The results are given of investigations in 1935–39 on the insecticidal properties of 44 species of plants indigenous in Mysore that were readily available and known as fish poisons or for their medical properties or commonly used as insect deterrents; derris (*Derris elliptica*), which had been introduced a few years previously, was also tested, for comparison. Dusts, aqueous suspensions and cold alcoholic extracts were prepared from various plant parts and tested in the laboratory against insects. When second- and third-instar larvae of *Prodenia litura* (F.), *Crocidolomia binotalis* Zell., *Plutella maculipennis* (Curt.), *Idiocerus* sp. and *Callosobruchus* (*Bruchus*) *chinensis* (L.) were allowed to crawl over the dusts for five minutes, one or more parts of 11 plants, including derris, gave 80 per cent. mortality within four days. When the first four insects and also *Euproctis fraterna* (Moore), *Epacromia tamulus* (F.) and *Coccus viridis colemani* Kannan were sprayed with suspensions at concentrations up to 20 per cent., the only toxicity noted was shown by 5 per cent. suspensions of derris root and the bark of *Mundulea sericea* (*suberosa*) tested on *Idiocerus*; no extracts were effective as stomach poisons, but those of about 25 plants gave 80 per cent. kill of one or more of the insects at concentrations of 3–10 per cent. when used as contact insecticides. In addition to derris root, extracts of the seeds of *Tephrosia candida* and *Annona squamosa* and bark of *M. sericea* were effective against all the insects.

As the insecticidal potency of fish-poison plants is usually due to the presence of rotenone, the materials showing toxicity were examined chemically for this compound, and their total ether and total alcohol extractives were compared with nicotine sulphate for toxicity to *C. v. colemani*. Only seeds and roots of *T. candida* and seeds of *T. villosa* showed the presence of rotenone, and no correlation was found between ether and alcohol extractives and toxicity to the insect; only the seeds of *T. candida* and *A. squamosa* and the bark of *M. sericea* were comparable in toxicity to nicotine sulphate or derris root.

Treatment with hot industrial alcohol completely extracted the active

principles from the bark of *M. sericea* and the seeds of *T. candida*, and the extracts formed stable emulsions suitable for uses as sprays when mixed with molasses as a wetting agent and diluted with water; the concentrations found toxic to various insects in laboratory and small-scale field tests are shown in a table and did not exceed 1 per cent. It is considered that these materials and the seeds of *Annona squamosa* are likely to be of commercial value as insecticides.

KHAN (M. Q.) & MURTHY (D. V.). **Some Observations on the Rice Stem Borer (*Schoenobius incertellus* Wlk.) in Hyderabad State.**—*Indian J. Ent.* **17** pt. 2 pp. 175–182, 8 refs. New Delhi, 1955.

Schoenobius bipunctifer (*incertellus*) (Wlk.) is one of the most important pests of rice in the State of Hyderabad, infestation resulting in dead-hearts in young plants and in empty ears at harvest. One crop of rice is grown in the rainy season, from mid-May to December, and one in the dry season, from December to May, and there appear to be about three generations of the borer in each, of which the first causes dead-hearts and the third empty ears, whereas the second does little damage; the injury to the young crop is less severe in the rainy season. Counts of infested ears at harvest in six sowings made at weekly intervals from the last week of June to the first in August in several years showed no significant relation between time of sowing and incidence of *S. bipunctifer* in the wet-season crop, but counts of dead-hearts in six dry-season sowings from the third week in December to the fourth in January showed that incidence was much higher in the early than in the late ones, and it appeared that any plants sown before 15th January would be subject to attack; delay of sowing after 10th February is also harmful, as attack by the last generation and other factors may adversely affect the yield. Experiments in 1953–54 indicated that varieties of rice vary in susceptibility to *Schoenobius*, and the reasons for this and the possibility of control by growing resistant varieties are discussed. *Trichogramma minutum* Ril., *Tetrastichus schoenobii* Ferrière and *Telenomus beneficiens* (Zehnt.) were observed parasitising the eggs of *S. bipunctifer* in the State.

ANANTANARAYANAN (K. P.) & VENUGOPAL (S.). **Notes on a new Pest, *Lepidogma* sp., (Pyralidae) on *Eugenia jambolana* in Coimbatore.**—*Indian J. Ent.* **17** pt. 2 pp. 183–185, 5 figs., 4 refs. New Delhi, 1955.

An undescribed species of *Lepidogma* was observed attacking *Eugenia cumini* (*jambolana*) at Coimbatore in March 1951, and investigations on its bionomics in 1952–53 showed that the eggs are laid in webbing on the shoots and hatch in four days. The young larvae are gregarious and feed on the surface of the leaves, causing them to wither, and the older ones make holes in fresh leaves, or injure the edges, living, usually not more than two together, in webbed clusters, in which they pupate. The larval and pupal stages last 28 and 7 days, respectively. The Pyralid can be controlled by hand-picking and destruction of infested leaves or by spraying with 1 lb. 50 per cent. wettable DDT per 30 gals. water.

ANANTANARAYANAN (K. P.). **A Note on a new Jassid Pest on Sugarcane from the Madras State.**—*Indian J. Ent.* **16** (1954) pt. 4 p. 372. New Delhi, 1955.

IZZARD (R. J.). **A new Genus and Species of Nirvaniinae (Homoptera, Cicadellidae) from south India.**—*Op. cit.* **17** pt. 2 pp. 186–188, 1 fig.

It is stated in the first of these papers that an unidentified Cicadellid was found infesting sugar-cane 8–10 months old in the South Kanara district

of Madras in September and October 1954. The insects occurred mainly on the lower leaf surfaces and were most numerous on crops suffering from a deficiency disease. Preliminary tests showed that spraying with 1 lb. 50 per cent. DDT per 30 gals. destroyed all stages. The Cicadellid is described from the adults as *Pruthiana sexnotata*, gen. et sp.n., in the second paper.

Muthu (M.) & Pingale (S. V.). **Extent of Variation caused by certain Factors in the Toxicity of Ethylene Dichloride-Carbon Tetrachloride Mixture to Insects.**—*Indian J. Ent.* **17** pt. 2 pp. 193–200, 5 graphs, 8 refs. New Delhi, 1955.

Investigations on the effect of various factors on the toxicity of 3:1 mixtures of ethylene dichloride and carbon tetrachloride to cereal pests were carried out in India with all stages of *Calandra* (*Sitophilus*) *oryzae* (L.), *Rhizopertha dominica* (F.), *Trogoderma granarium* Everts and *Tribolium castaneum* (Hbst.) and the immature stages of *Corcyra cephalonica* (Stnt.) in wheat with a moisture content of 11·5–12·5 per cent. at temperatures of 83–87°F. and 50–60 per cent. relative humidity.

Vessels containing 16 lb. infested wheat, which took up 87·5 per cent. of the space, were evacuated to a pressure of 15 ins. mercury, the required quantity of fumigant was introduced, and atmospheric pressure was restored after 15 minutes. Mortality counts made after fumigation with various doses for 48 hours showed that eggs and pupae were more resistant than larvae and adults, and those of *Calandra* more so than those of the other species. This weevil and *R. dominica* bore into the grain to breed, and therefore require higher dosages than the others, which do not. Tests in which wheat containing eggs of *Calandra* was fumigated for 48 hours with 30 lb. per 1,000 cu. ft. at constant temperatures of 60, 70, 80 and 90°F. showed that mortality increased as the temperature rose, and similar tests at temperatures alternating between 60 and 90 every 12, 16 or 24 hours showed that the best results were obtained when fumigation was begun at the higher temperature. Comparison of gas samples taken from the vessels and from the top, middle and bottom of bagged grain under a gas-tight sheet 24, 48, 72 and 96 hours after the application of the fumigant showed that concentrations were lower under the sheet, owing to higher sorption of the gas, presumably by the jute bags, and that they were noticeably higher at the bottom than at the top of the wheat after 48 hours.

From the results obtained, the authors estimate the concentrations necessary for the control of boring and non-boring insects in bulk and bagged grain at various average temperatures for an exposure of 48 hours.

Banerjee (S. N.) & Chatterjee (B. K.). **Studies on *Gryllotalpa africana* Palisot de Beauvois—a new major Pest of the Potato Crop (*Solanum tuberosum* Linn.)—and its Control.**—*Indian J. Ent.* **17** pt. 2 pp. 219–229, 4 figs., 15 refs. New Delhi, 1955.

Potatoes harvested in West Bengal late in 1949 were found to show numerous holes caused by the tunnelling of *Gryllotalpa africana* P. de B. This mole-cricket lives in ramifying underground burrows, mainly at a depth of 6–10 ins. in the damper parts of the fields, and also injures other crops. Laboratory and field observations showed that it fed on the tubers as well as boring through them mechanically; 80–90 per cent. of them were injured in some areas. Control of the Gryllids by flooding them out of their burrows is impossible in potato fields, because of their comparatively high level and the possible injury to the crop. Dusting or spraying the plants with BHC or DDT proved ineffective, and soil treatments with these insecticides were

therefore tested in 1950–52, in a heavily infested field of loamy soil. BHC at 4 per cent. in talc (0·52 per cent. γ isomer) and 4 per cent. DDT in talc were applied to plots at 30 lb. per acre in December 1950 and dug in to a depth of 7–8 ins. and harrowed, and potatoes were planted on 22nd–25th December and harvested between 30th March and 2nd April 1951. Statistical analysis of the results showed that BHC caused a significant reduction in the percentage of tubers damaged, whereas DDT did not, and that neither treatment significantly affected the yield; BHC did not appear to taint the cooked tubers.

Agrawal (N. S.). **Bionomics of** *Atractomorpha crenulata* **Fab. (Orthoptera: Acrididae).**—*Indian J. Ent.* **17** pt. 2 pp. 230–240, 7 figs., 23 refs. New Delhi, 1955.

Atractomorpha crenulata (F.), all stages of which are described, occurs throughout India and damages plants of many species. Those on which this grasshopper was observed to feed during investigations at Kanpur, Uttar Pradesh, in 1947–49 are listed; when leaves were supplied to hoppers in the laboratory, brinjal [*Solanum melongena*] and cruciferous crops were preferred, and tobacco was attacked only in the absence of other plants. Low-growing plants were the most severely injured, and adult females ate many times more than males or nymphs. Mating occurred 4–13 days after the last moult, and oviposition followed after 1–5 days. The eggs were laid in masses of 20–30 at depths of 3–4 ins. in the soil, between mid-February and the third week of November; females deposited 64–136 eggs each over periods of 11–17 days. The incubation period varied from 15 days in April–August to 66 for eggs deposited in late November, and the nymphal stage from 31–39 days in July and August to 31–69 in November–January. About 75–100 per cent. of the eggs hatched, and 53·5–66·6 per cent. of the nymphs reached maturity. Male adults lived for 25–36 days and females for 30–68. *A. crenulata* is injurious throughout the year, but least so in December and January. The population is highest in August and lowest in May, females equalling or exceeding males in numbers in August and September.

Siddiqi (A. A.). **Residual Toxicity of certain Insecticides in the Control of the Tobacco Budworm,** *Heliothis virescens* **(F.).**—*Indian J. Ent.* **17** pt. 2 pp. 241–244, 1 graph, 7 refs. New Delhi, 1955.

Field investigations on the toxicity of the deposits from emulsion sprays of endrin, DDT and toxaphene to *Heliothis virescens* (F.) on tobacco were carried out in Louisiana in 1953–54. Plants in plots were sprayed with the three compounds at rates of 0·2, 0·5 and 2 lb. toxicant, respectively, per acre, and third-instar larvae were caged on them immediately or after 24–96 hours and examined 48 hours later. Mortality percentages were calculated according to Abbott's formula [*R.A.E.*, A **13** 331], and it was found that the three materials gave averages of 98·05, 96·11 and 90·97 per cent. mortality immediately, 73·39, 67·7 and 55·75 per cent. after 48 hours, 31·61, 29·16 and 22·44 per cent. after 72 hours, and less than 13 per cent. after 96.

Butani (D. K.). **The Influence of Temperature on the Development of Insects, with special Reference to** *Chilo zonellus*, **S.**—*Indian J. Ent.* **17** pt. 2 pp. 280–282. New Delhi, 1955.

Observations, under controlled conditions in the laboratory, on *Chilo zonellus* (Swinh.), which bores in the stems of sorghum, maize and sugarcane in India, showed that the eggs did not hatch at temperatures of 50–55 or

91–95°F., and that the incubation period increased from four days at 81–90° to nine at 56–60°. The larvae did not complete their development below 55 or above 96°F., and pupation reached a maximum of 60 per cent. at 71–75°F. Adult emergence did not occur below 60 or above 96°, and reached a maximum of 70 per cent. at 86–90°F. Adult life varied from 12 days at 56–60° to one day at 101–105°, and the moths died in a few hours at temperatures above 106°. Under natural conditions in the laboratory, the durations of the egg, larval and pupal stages increased from 4–5, 18–21 and 6–8 days, respectively, in summer to 8–9, 28–193 and 9–12 in winter, and the complete life-cycle from 29–33 days in summer to 83–210 days in winter.

Sengupta (G. C.) & Behura (B. K.). **Some new Records of Crop Pests from India.**—*Indian J. Ent.* **17** pt. 2 pp. 283–285, 1 fig. New Delhi, 1955.

The pests recorded, all from the State of Orissa, are *Noorda albizonalis* Hmps., *Ctenomeristis ebriola* Meyr. and *Dichocrocis* sp., the larvae of which bore in young mango fruits; *Lema praeusta* (F.), *L. signatipennis* Jacoby and *L. semiregularis* Jacoby, which attack turmeric, the first two causing considerable damage to the leaves; *Melittia bombiliformis* (Cram.), which bores in the stems of cucurbits; and *Icerya purchasi* Mask., which is an important pest of *Citrus*.

Marshall (Sir G. A. K.). **Some injurious Curculionidae (Col.) from New Guinea.**—*Bull. ent. Res.* **48** pt. 1 pp. 1–7, 4 figs. London, 1957.

The four new species described, the first from males only and the rest from adults of both sexes, are *Paratactus lihirensis*, from Lihir Island, *Oribius destructor* and *O. hostis*, from the highlands of New Guinea, and *Pantorhytes szentivanyi*, from Papua. The adults of the two species of *Oribius* damage the leaves of coffee, and those of *O. destructor* are also recorded from the berries and from other plants, including cabbage, sweet potato and *Citrus*. Larvae of *O. destructor* were found round the roots of various weeds. *Paratactus lihirensis* feeds on the leaves of cacao, and characters are given distinguishing from it *P. carbunculus* (Heller), which is known only from New Britain and has been taken on cotton and the leaves of pumpkin there. *Pantorhytes szentivanyi* is closely allied to *P. proximus* Faust [and the larvae bore in the stems of cacao (*cf. R.A.E.*, A **45** 34)].

Howe (R. W.). **A Laboratory Study of the Cigarette Beetle, *Lasioderma serricorne* (F.) (Col., Anobiidae) with a critical Review of the Literature on its Biology.**—*Bull. ent. Res.* **48** pt. 1 pp. 9–56, 2 pls., 5 figs., 8 pp. refs. London, 1957.

Lasioderma serricorne (F.) has become the chief pest of stored cacao in Nigeria [*cf. R.A.E.*, A **40** 201; **45** 217], and as its bionomics have been studied mainly on tobacco, which is a rather poor food, investigations were made in which the principal medium was wheatfeed, which is more nutritious. An account of the work is given, together with characters distinguishing the adults and larvae from those of *Stegobium paniceum* (L.), with which it has sometimes been confused, a comprehensive review of the literature on its life-history and control, and a list of the stored products from which it has been recorded.

The following is based partly on the author's summary of the results of the rearing experiments. All stages developed at temperatures from just below 20°C. [68°F.] to 37·5°C. [99·5°F.] at favourable relative humidities; the egg stage was shortest (about six days) at 35°C. [95°F.] and the optima for rapid larval development were 32·5°C. [90·5°F.] at relative humidities above about 40 per cent. and 30°C. [86°F.] at lower humidities. The optimum relative humidity was 70–80 per cent. At 37·5°C., larvae died at 90 per cent. relative humidity. The lower limit of relative humidity was under 25 per cent. at 30°C., but rise or fall of temperature raised it, so that at 20 and 37·5°C. all larvae died at 40 per cent. relative humidity. When the food was groundnuts, which contain less water than wheatfeed, the effects of low humidity were more rigorous. At 30°C. and 70 per cent. relative humidity, the larvae passed through four instars and formed their cocoons after about 19 days; there was 13 per cent. mortality, mostly in the first instar. Neither the pupal stage nor the period passed by the adult in the cocoon prior to emergence was influenced by humidity; both were shortest (about 3–4·5 days) at 30–35°C. Development of individuals reared singly on wheatfeed was completed in a mean of 26·1 days, and there was 12 per cent. mortality among the immature stages. Development was also rapid, lasting 26·5–31·6 days, on wholemeal flour, cottonseed and coconut meals, yeast powder, and crushed, damaged and whole cowpeas; there was no mortality on wholemeal flour or yeast, only 7 per cent. on the two meals, and 37 per cent. on whole cowpeas. Development was fairly rapid (33–34 days) on whole garden peas (on which, however, mortality was 97 per cent.) and groundnuts and crushed locust beans [*Ceratonia siliqua*], but it lasted 68·5, 105·6 and 55·2 days, respectively, on whole locust beans and whole and crushed cacao beans; mortality on the last two was 85 and 14 per cent., respectively. When larvae were reared in batches of 20 on wholemeal flour, the duration of development was not affected, but mortality increased to 10 per cent.; on whole, crushed and damaged cowpeas, development was slightly retarded, but mortality was reduced on the first two.

In the stocks fed on wheatfeed, adults were heaviest when reared at 25°C. [77°F.] and 100 per cent. relative humidity; those reared on other foods were rather lighter. The sex ratio was unity. The duration of the pre-oviposition period did not exceed two days from the time of emergence from the cocoon. In tests at 70 per cent. relative humidity and a wide range of temperatures, no fertile eggs were laid at 37·5°C. and few eggs were laid at 20°C.; temperature otherwise had little effect. The theoretical weekly rate of increase at 70 per cent. relative humidity rose from 3 per cent. at 20°C. to 112 per cent. at 35°C. In the laboratory, the number of generations per year ranged from three at 20°C. to 11 at 30–35°C. Breeding can be expected to occur in places where temperatures exceed about 19°C. [66·2°F.] in produce stored outdoors or in warehouses; in hot regions, high temperatures are unlikely to inhibit reproduction, but conditions may be too dry for great increase, especially in products with a low moisture content. When larvae reared at 30°C. and 70 per cent. relative humidity were exposed for a week to 40°C. [104°F.] at hatching or after one or two weeks, their development was retarded by amounts that increased with their age at exposure, but mortality during exposure decreased with age; only one adult emerged from 15 pupae exposed at 40°C. In tests on the effects of low temperatures on adults, complete mortality occurred after exposure to −13, −12·5, −9 and −5·5°C. [8·6, 9·5, 15·8 and 22·1°F.] for 2, 4, 8 and 96 hours, respectively; adults that survived were fertile. The areas of the world in which *L. serricorne* would be expected to survive the cold period, with and without artificial heat, and to complete its development, together with the probable number of generations per year in different regions, are shown on a map, and the expected and recorded distributions are discussed.

Miller (N. C. E.). **Two new Species of *Pseudodoniella* China & Carvalho (Hemiptera, Miridae).**—*Bull. ent. Res.* **48** pt. 1 pp. 57–58, 1 fig., 1 ref. London, 1957.

The new species described are *Pseudodoniella laensis* and *P. szentivanyi*, which feed on cacao in New Guinea and Papua, respectively. *Parabryocoropsis duni* China & Carvalho and *P. chcesmanae* China & Carvalho [*R.A.E.*, A **40** 6] are transferred to *Pseudodoniella*, and a key is given to the five species of this genus now recognised [*cf. loc. cit.*].

Riley (J.). **A Survey of the Build-up of Infestation in bagged Cocoa Beans in Store in Western Nigeria.**—*Bull. ent. Res.* **48** pt. 1 pp. 75–78, 2 refs. London, 1957.

The following is based partly on the author's summary. The insects present in two tons of cacao beans in 32 bags stacked in a typical store at Ibadan, Nigeria, were sampled regularly from mid-December 1953, when the cacao was put in store, till the end of April 1954. Weekly counts of the insects caught on strands consisting of the mid-ribs of palm leaves coated with an adhesive [*cf. R.A.E.*, A **30** 212] hung vertically round the stack varied considerably and suggested that *Ephestia cautella* (Wlk.) was the most numerous species present, but counts of the insects in samples of beans taken every two weeks with a sampling spear showed that populations of this moth in the beans remained small and fairly constant throughout the period. The most serious pest was shown to be *Lasioderma serricorne* (F.), estimated populations of which in the 32 bags increased steadily during the 19 weeks from less than 200 to some 6,400. Since the life-cycle during January–March averages ten weeks, this represents the increase during about two generations, and it is concluded that initially uninfested cacao cannot safely be left in store for more than 25 weeks in Nigeria during the main crop season. Nine other species were taken, mostly in small numbers, on the strands, but *Tribolium castaneum* (Hbst.) and *Laemophloeus* sp. were the only ones also found in the beans.

Southgate (B. J.), Howe (R. W.) & Brett (G. A.). **The specific Status of *Callosobruchus maculatus* (F.) and *Callosobruchus analis* (F.).**—*Bull. ent. Res.* **48** pt. 1 pp. 79–89, 2 pls., 6 figs., 24 refs. London, 1957.

It is not clear from the original descriptions and subsequent literature whether or not *Callosobruchus* (*Bruchus*) *analis* (F.) is a synonym of *C.* (*B.*) *maculatus* (F.). The authors have cultures of both these Bruchids identified by comparison with type material and conclude that they are distinct. Two specimens thought to be the type material of *C. maculatus*, which was described from America, were found to comprise one here designated the lectotype of that species and one found to be *C. analis*, which was described from the Oriental region and is not otherwise known from America. The original descriptions are based on ground colour and the patterns formed by the pubescence, and the confusion that has arisen is largely due to the considerable variation in colour shown by *C. maculatus*. The adults of *C. analis* and *C. maculatus* are redescribed from material from the cultures, and descriptions of the genitalia of both sexes and characters differentiating the two species are given.

Specimens of *C. analis* in the British Museum include some originally identified by Pic as *Bruchus jekeli* Allib. and *B. glaber* Allib. The types of these species are unknown, but if the determinations were correct, as comparison with the original descriptions indicates, both are identical with

C. analis. Ten other names have been mentioned in the literature as synonyms of *C. maculatus*, and it is concluded from an examination of types or descriptions that they apply to four species, one of which is given a new name. These are *C. maculatus* (*Bruchus quadrimaculatus* F., *B. ornatus* Boh., *B. vicinus* Gylh., *B. ambiguus* Gylh., *B. sinuatus* Fhs.); *C.* (*Curculio*) *chinensis* (L.) (*B. barbicornis* F., *B. bistriatus* F.); *B. longicornis* Thnb. (*litteratus* Schönh.); and *Bruchidius thunbergi*, n.n., proposed for *Bruchus chinensis* Thnb. (nec *Curculio chinensis* L.).

David (W. A. L.). **Insecticidal Action Studies with Demeton-O and Demeton-S.**—*Bull. ent. Res.* **48** pt. 1 pp. 91–107, 15 refs. London, 1957.

The following is virtually the author's summary. The two isomers demeton-O [O,O-diethyl O-2-(ethylthio)ethyl phosphorothioate] and demeton-S [O,O-diethyl S-2-(ethylthio)ethyl phosphorothioate], which occur as a mixture called demeton in the commercial insecticide Systox, act on *Aphis fabae* Scop. as contact and systemic insecticides and as fumigants [*cf. R.A.E.*, A **43** 8–9]. When applied, in the experiments described, as a contact insecticide or systemically through the roots from solution or from soil, demeton-S was about ten times as toxic to *A. fabae* on broad beans (*Vicia faba*) as demeton-O. Using demeton-S containing ^{32}P, it was shown that, when applied to the roots, radioactive material passed to all parts of the plants and that the concentration in the aerial parts was higher than in the roots. Leaf samples were more active than stem samples. By radioassay and by the cut-taproot technique [**39** 200], it appeared that the lethal dose of demeton-S was equivalent to about 1 mg. per kg. fresh plant tissue. The lethal dose of demeton-O by the cut-taproot technique was 3 mg. per kg. From solutions of demeton-S, the plants first absorbed demeton-S preferentially [*cf.* **40** 273], then water preferentially. Demeton-S was more rapidly absorbed from sand than from soil. Both isomers were translocated from older to younger leaves of broad beans, usually in sufficient quantities to kill Aphids, but the results were more consistent with demeton-S. The quantity translocated downwards was small [*cf.* **43** 132]. A low light intensity before and after treatment reduced the quantity of demeton-S translocated. There was also a reduction in the quantity translocated when the plants were shaded only before treatment. One day of shading was sufficient to cause the maximum reduction. Solutions of the two isomers gave off toxic vapours, and plants treated through the roots gave off toxic vapours from the foliage.

Beament (J. W. L.) & Lal (R.). **Penetration through the Egg-shell of *Pieris brassicae* (L.).**—*Bull. ent. Res.* **48** pt. 1 pp. 109–125, 1 fig., 12 refs. London, 1957.

The following is based on the authors' introduction and summary. An account is given of an investigation into such parts of the structure, chemical composition and modifications of the envelopes of the eggs of *Pieris brassicae* (L.) as might indicate how toxic materials and simple chemical compounds pass from the outside to the living contents. It was not carried out to obtain useful ovicidal materials, but it was hoped that it might provide an outline of the broad principles governing the mechanism of penetration into eggs of Lepidoptera similar to that already given for the eggs of some other arthropods [*cf. R.A.E.*, A **37** 110, 217; **39** 197].

The rigid outer shell was found to consist of two proteinaceous layers, covered externally by a relatively hydrofuge cement, by which the egg is

attached to the leaf surface. The egg has respiratory pores over its surface, and a single apical micropyle penetrating these layers. The inside of the rigid shell is lined with a layer of unsaturated oil, which is unusual in insect eggs. When the egg is first laid, the vitelline membrane is directly applied to the inner surface of the solid shell over the region immediately round the micropyle, but within four hours this contact is broken, and the oil layer flows into this region also and becomes complete. As development proceeds, the vitelline layer is replaced by membranes of embryonic origin, but before eclosion both these epembryonic layers, and also the oil, are resorbed.

The egg was found to be remarkably resistant to water-soluble poisons that have no oil solubility, except during the first four hours of development. This resistance is attributed almost entirely to the oil layer, and the early susceptibility to its absence over the micropylar region. These changes were not reflected in the effect of oil-soluble poisons or fumigants. The solid portions of the shell do not seem to be of great importance in restricting the entry of liquid poisons, even though the cement is comparatively hydrofuge. From experiments with wetting agents and with eggs immersed in poisons under vacuum, it does not appear that the respiratory air spaces in the shell are preferential channels of access; rather, the poisons penetrate through the solid portions of the shell. This penetration, even of oil-soluble materials, is slow, for they can be effectively washed out of the shell again some considerable time after dipping. On the other hand, non-volatile oily materials can interfere with the respiration of the egg by blocking the air spaces in the shell.

The secretion of epembryonic layers did not appear to change the resistance of the egg to water-soluble materials; this is to be expected, for they do not contain lipoid. On the other hand, they do add appreciably to the resistance to oil-soluble materials. There is no evidence that poisons are accumulated in these epembryonic membranes and released during the pre-eclosion period. The results of experiments with covalent compounds, such as mercuric chloride, suggest that their oil-solubility accounts for their toxicity, whereas electrovalent compounds containing similar heavy metals are effective only while the direct micropylar path of entry is available to them.

Laughlin (R.). **Biology and Ecology of the Garden Chafer, *Phyllopertha horticola* (L.). III. The Growth of the Larva.**—*Bull. ent. Res.* **48** pt. 1 pp. 127–154, 6 figs., 8 refs. London, 1957.

Previous work on the bionomics of *Anomala* (*Phyllopertha*) *horticola* (L.) in Britain [*R.A.E.*, A **44** 184] showed that under natural conditions in the Lake District the larvae feed actively on the roots of pasture plants from early July until the middle or end of October, when the stores of organic matter in the grass roots are highest, and that egg production depends almost entirely on the weight of the hibernating larva or the pupa, which is thus important in determining the reproductive rate of the population. Studies were accordingly made on larval growth and certain factors affecting it, and the following is virtually the author's summary of the results.

Newly hatched larvae cultured at 15°C. [59°F.] in moistened plaster containers filled with a mixture of soil and germinating grass seeds moulted about 20 and 45 days after hatching and entered hibernation after about 100 days. When the seeds were scattered on the soil surface, larval growth was slower. The mean larval weight, plotted against age, gave a sigmoid curve; in the first instar and most of the second, the rate of increase in weight was proportional to the weight, but thereafter, up to the time of hibernation, it was more or less constant. The rate of growth of the individual larva was

irregular, being slower at the moults and variable even in the middle of the instar. Larvae cultured under semi-natural conditions in pots of growing grass in the open moulted about 3–4 and 7–9 weeks after hatching and entered hibernation at 100–120 days. Larvae cultured on 13 species of pasture plants survived to the hibernation stage on all but two of them.

During hibernation, larvae lost 20–25 per cent. of their weight, mostly in the first few weeks. The pupal weight is almost constant, and did not appear to be affected by the temperature treatment of the hibernating larvae. It is thus a useful index of effective larval growth. The mean and (in brackets) range of the weights of all pupae collected in two fields in the Lake District between 1950 and 1953 were 139·3 mg. (65–242) for males and 171·3 mg. (72–310) for females. Field samples of hibernating larvae and of pupae showed considerable variation in weight from place to place, from year to year, and within apparently homogenous areas. Variation in the time at which larval growth takes place is a major cause of variation in pupal weight. The growth period of larvae in a field at Buttermere was three weeks earlier in 1952 than in 1950, though of the same duration, and the resulting pupae in 1953 were heavier than those in 1951. Two lots of larvae of similar parentage, reared in adjacent plots of grass out of doors, of which one both hatched and entered hibernation three weeks before the other, likewise showed a difference in weight at hibernation, the earlier lot being the heavier. A series of weighed samples of larvae taken from part of a field at Ambleside in 1953 at weekly intervals during the period when they were entering hibernation showed that heavier individuals did so before lighter ones and males before females. Factors inducing mortality during this period thus operate selectively against females, because these are exposed to them for longer. Field-collected larvae that fed in the third instar on roots of lettuce produced pupae in the following spring that were significantly heavier than those from larvae that fed on roots of either ryegrass [*Lolium perenne*] or clover. No evidence was obtained to show that population density affects the weight of the hibernating larva or the pupa. On the other hand, larvae from soil from which the damaged turf had been stripped by birds were significantly lighter than those from the surrounding undisturbed sward. When moving through the soil, larvae may meet and fatally injure each other by an undirected " snapping " reaction. This mechanism may limit population density. In an experiment in which larvae were reared in loose soil on grass roots, the mortality rate was seen to increase with the size and activity of the larvae, and also with the larval density.

Ayappa (P. K.), Cheema (P. S.) & Perti (S. L.). **A Life-history Study of *Anthrenus flavipes* Lec. (Col., Dermestidae).**—*Bull. ent. Res.* **48** pt. 1 pp. 185–198, 2 figs., 19 refs. London, 1957.

Laboratory studies on the bionomics of *Anthrenus flavipes* Lec. were carried out in India to provide information on which a technique for rearing standard cultures could be based, and an account of the results, which are discussed with reference to the literature [*cf. R.A.E.*, A **25** 291; **30** 556], is here given, together with brief descriptions of the immature stages and characters for the separation of the sexes in the pupae and adults. The stock was reared on hog bristles at constant temperatures, usually 25, 30 and 35°C. [77, 86 and 95°F.], and relative humidities, usually 30 and 90 per cent., and also in a room with a controlled relative humidity of 70–75 per cent. and a temperature that fluctuated over the year between 25 and 31°C. [87·8°F.]. The following is based mainly on the authors' summary of the results.

The egg stage lasted about 13, 8, 6 and 4 days, respectively, at 25, 30, 35 and 37·5°C. [99·5°F.] and seven days at the fluctuating temperature. Most of the eggs were viable at the fluctuating temperature and at 37·5°C., and rather fewer at 35°C. Larval development was appreciably more rapid under the first two of these temperature conditions, but there were more instars at the constant temperatures. Mortality was lowest at the fluctuating temperature. In tests of different diets, larval development lasted 38–41 days on woollen fabric impregnated with 10–20 per cent. yeast, 118–253 days on woollen fabric impregnated with 1–5 per cent. yeast, an extract of cow dung or a mixture of glucose and albumin, 339 days on untreated woollen cloth or a mixture of wool and cotton, on both of which survival was low, and 223 days on hog bristle, on which survival was 46 per cent. There was no development on cotton or silk fabrics alone or impregnated with yeast. The pupal stage lasted 14, 12 and 7 days at 25, 30 and 35°C., respectively, and nine days at the fluctuating temperature. Emergence was highest (73·3–75 per cent.) from pupae reared at 35°C. Humidity did not affect the duration of the egg, larval or pupal stages, the viability of the eggs, or the number of larval instars. The adults remained quiescent for 5–9 days after emergence and survived for longer (36 days for males and 40 for females) at 25°C. than at the fluctuating temperature or at 30 or 35°C.; at 35°C., survival was longer at 90 than at 30 per cent. relative humidity. At 25–31°C., males, but not females, survived for longer when bristles smeared with glucose and albumin were provided than with bristles alone. The pre-oviposition, oviposition and post-oviposition periods were all longer at 25°C. and 50–60 per cent. relative humidity than at 30 or 35°C. and 30 or 90 per cent. Females laid most eggs when kept at the fluctuating temperature and more when fed on hog bristles smeared with glucose and albumin (36 each) than on bristles smeared with cow-dung extract (32) or bristles alone (13). The ratio of males to females was 0·8:1. The life-span from egg to death was shortest at 35°C. and varied inversely with temperature; under the experimental conditions, 1–1½ generations could develop per year.

Johnson (C. G.), Southwood (T. R. E.) & Entwistle (H. M.). **A new Method of extracting Arthropods and Molluscs from Grassland and Herbage with a Suction Apparatus.**—*Bull. ent. Res.* **48** pt. 1 pp. 211–218, 1 pl., 3 figs., 1 ref. London, 1957.

The following is almost entirely the authors' summary. A new method of extracting free-living arthropods and molluscs from rough, matted grassland has been developed that gives extraction rates usually above 95 per cent. Its advantages over other known methods, especially sweeping, are that it is less liable to personal error, collects from otherwise inaccessible places in the habitat, permits selection of places within the habitat, such as the tops and bases of grass, and does not depend on removal of parts of the habitat. The apparatus consists of a light, portable but powerful, electric suction pump of standard pattern, with a special compartment containing a small collecting bag fitted between the fan intake and a flexible hose that carries a nozzle 1 in. in diameter, which is inserted into the grass. It can be operated on several hundred yards of cable. The sample obtained comprises a mass of plant matter and detritus from which the animals are easily sorted by hand in the laboratory. The method is unsuitable for subterranean arthropods or for insects living inside or otherwise firmly attached to plants, and is not entirely suitable for Dipterous larvae and pupae, Coleopterous larvae, and millepedes; it should be possible to use it for a variety of habitats other than grassland.

Miles (M.). **Studies of British Anthomyiid Flies. VIII. The Carnation Fly,** *Hylemyia brunnescens* **(Zett.).**—*Bull. ent. Res.* **48** pt. 1 pp. 219–228, 4 figs., 10 refs. London, 1957.

The following is based on the author's summary of this part of a series [*cf. R.A.E.*, A **43** 166, etc.], in which an account is given of observations on the bionomics of *Hylemyia brunnescens* (Zett.) in south-eastern England. This Anthomyiid, all stages of which are described, frequently infests carnations, pinks and sweet williams (*Dianthus* spp.) and was recently found on the last two in Kent.

Oviposition began in the field on 7th September in 1954 and 12th September in 1955, and eggs were present until early November. Females reared in cages in 1955 oviposited only between 16th August and 26th September. The eggs were laid on the leaves, usually on the upper surfaces, or in their axils, and the larvae mined in the leaves or shoots, completely destroying the mesophyll and leaving large quantities of dry, green frass in the cavity. They were present in the field from mid-September to mid-April. In the insectary, larvae collected in September finished feeding in November and entered the soil, but those collected later remained on the plants and fed intermittently during January and February whenever the temperature was suitable. Larvae on plants in the open survived exposure to severe frost. Pupation occurred from late March to mid-April, and the pupal stage lasted about eight weeks. Adults emerged between 4th and 20th June in 1955, with a peak during 6th–12th June, and between 30th May and 4th June in 1950, 2nd and 9th June in 1953 and 16th and 26th May in 1954. They survived for 2–4 months in captivity. The adults were active during the summer, but they did not reach sexual maturity and eggs were not laid until August. There is thus only one generation a year, the larval period always occurring in autumn, when the foliage of the plants is freshest and most abundant. Reports from southern England of larvae attacking *Dianthus* spp. in June–August probably refer to the Agromyzid, *Phytobia* (*Dizygomyza*) *flavifrons* (Mg.), which feeds only on the surfaces of the mesophyll, causing the formation of conspicuous white blisters, whereas larvae of *H. brunnescens* feed in parallel, longitudinal mines.

Allen (M. D.) & Selman (I. W.). **The Response of Larvae of the Large White Butterfly** (*Pieris brassicae* **(L.)) to Diets of Mineral-deficient Leaves.**—*Bull. ent. Res.* **48** pt. 1 pp. 229–242, 10 figs., 17 refs. London, 1957.

Little is known of the responses of leaf-eating caterpillars to the mineral nutrition of their food-plants. When larvae of *Pieris brassicae* (L.) were reared on leaves of cruciferous plants growing in nutrient solutions deficient in nitrogen, phosphorus, potassium or iron or on iron-deficient leaves from the sixth day of development or during the last two instars, they weighed significantly less than those fed on normal leaves and, in addition, the date of pupation was significantly delayed. The rate of growth was significantly reduced by diets deficient in nitrogen or iron throughout development or in iron from the sixth day or during the last two instars, but it appeared from the tests with the iron-deficient leaves that the larvae are able to recover to some extent from the effects of a deficient diet, particularly if administered in the early stages of development. Mortality was significantly increased by deficiency of nitrogen throughout development or of iron during the first six days. In preliminary tests in which larvae were reared on iron-deficient leaves to which aqueous sprays containing ferric chloride, mixtures of sucrose and glucose, egg albumin or yeast had been applied, no beneficial results were observed.

Klapperich (B. J.). **Control of the Oriental Red Mite on Citrus Seedlings in Jordan.**—*FAO Plant Prot. Bull.* **5** no. 4 pp. 57–58. Rome, 1957.

To facilitate the extension of *Citrus* cultivation in Jordan, nurseries have been established in various districts to supply planting material. The most important of the pests attacking the seedlings is *Eutetranychus banksi* (McG.) (*Anychus orientalis* (Zacher)), which feeds on the upper surfaces of the leaves, causing them to become chlorotic. All stages of the mite are present throughout the year, the damage being most apparent in summer and autumn. The optimum conditions for the development of all stages are 21–27°C. [69·8–80·6°F.] and a relative humidity of 59–70 per cent. Under almost optimum conditions in the laboratory, females laid up to 32 eggs each, at a rate of up to eight per day, mainly along the mid-ribs on the upper surfaces of the leaves, and the eggs hatched in 2·5–3 days. Unfertilised females gave rise to males only. The nymphal stage lasted about eight days, and pairing and oviposition began almost immediately after the last moult. Up to 18 generations a year are possible in the field in Jordan.

Control tests were carried out in September 1956 on severely infested seedlings, some having up to 200 mites per leaf, in an irrigated nursery in the eastern Jordan Valley. In the first plot, where the seedlings were about 8–12 ins. high, the roots of each plant were watered with 250 cc. of a solution containing 0·1 per cent. Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] and in the second, where the seedlings were 14–34 ins. high, they received 500 cc. 0·2 per cent. demeton. Mortality was complete in 55 and 31 hours, and the plants remained free from infestation for 26 and 41 days, respectively. Infestation remained normal on untreated seedlings. In a subsidiary test at Jericho, good control of the larvae of *Polyphylla* sp. infesting *Eucalyptus* and *Acacia* seedlings was given by a single root application of 250 cc. 0·2 per cent. demeton.

Gojmerac (W. L.) & Callenbach (J. A.). **Sugar Beet Root Maggot. One Year's Trials in Red River Valley show that chemical Control is feasible.** —*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **18** no. 4 pp. 115–120, 2 figs. Fargo, N. Dak., 1956.

Gojmerac (W. L.). **Phosphates as Soil Insecticides for the Control of Sugar Beet Root Maggot.**—*FAO Plant Prot. Bull.* **5** no. 4 pp. 59–60, 2 refs. Rome, 1957.

An account is given in the first paper of experiments in North Dakota in 1955 on the control of *Tetanops* (*Eurycephalomyia*) *myopaeformis* (Röder), the larvae of which cause considerable damage by feeding on the roots of sugar-beet. Spraying the soil against the adults of this Otitid and treatment of the seed before sowing with organic insecticides both proved ineffective, but promising results were obtained when insecticides were mixed with fertiliser and applied to the rows with the seed. Aldrin, heptachlor and dieldrin were used in 25, 25 and 10 per cent. granular formulations, respectively, and applied at 1 and 2 lb. per acre, and dieldrin was also tested at 2 lb. per acre in a 50 per cent. wettable powder. Treatment somewhat reduced the percentage germination as compared with the controls, but the stands were satisfactory after thinning, and counts on 1st August showed that the insecticides had afforded good protection from the larvae. At harvest, the yield of beets, in 1 lb. per 100 ft. of row, as compared with 238·5 for no treatment, were 356 and 374·5 for 1 and 2 lb. aldrin, 394 and 386·5 for 1 and 2 lb. heptachlor, and 301·5 and 363 for 1 and 2 lb. dieldrin in granules, and 384 for the dieldrin wettable powder. No insecticidal

residues remained in the roots or the foliage at harvest, and there was no significant effect on the sugar content.

The work described in the second paper was carried out in an attempt to find less phytotoxic treatments, and the materials tested were Am. Cyanamid 3911 [O,O-diethyl S-ethylthiomethyl phosphorodithioate], AC 528 [2,3-p-dioxandithiol S,S-bis(O,O-diethyl phosphorodithioate)], Dow ET-14 [O,O-dimethyl O-2,4,5-trichlorophenyl phosphorothioate], Dow ET-15 [O-methyl O-2,4,5-trichlorophenyl phosphoramidothioate] and malathion. Seed treatments were effected by mixing the insecticides with a 5 per cent. solution of methylcellulose, and the average numbers of seedlings per 100 ins. of row before thinning were reduced from 103–112 for no treatment to 25 by an emulsion concentrate containing 90 per cent. Am. Cyanamid 3911, applied at 1 and 2 lb. per 100 lb. seed, 68 by a wettable powder containing 25 per cent. AC 528, at 1 lb. per 100 lb. seed, and 80 by 50 per cent. Am. Cyanamid 3911 on carbon, at 1 lb. per 100 lb. seed. The calculated yields in tons per acre were 9·4, 9, 11 and 9·5, respectively, as compared with 7·8–8 for no treatment. When the insecticides were applied under the same conditions with fertiliser, the average seedling stands per 100 ins. of row were 26 and 12 for a wettable powder containing 25 per cent. Dow ET-14, applied at 1 and 2 lb. per acre, respectively, 15 for a wettable powder containing 25 per cent. Dow ET-15 at 1 and 2 lb. per acre, and 34 and 24 for 50 per cent. Am. Cyanamid 3911 on carbon, at 1 and 2 lb. per acre, respectively. The corresponding calculated yields in tons per acre were 10, 8·5, 6·1, 5·6, 11·6 and 10·5. A wettable powder containing 25 per cent. malathion, applied at 2 lb. per acre, gave stands of 19–42 seedlings per 100 ins. of row and a calculated yield of 4·5–5·8 tons per acre.

Malcolm (D. R.). **Biology and Control of the Timothy Mite,** *Paratetranychus pratensis* **(Banks).**—*Tech. Bull. Wash. agric. Exp. Sta.* no. 17, [2+] 35 pp., 15 figs., 15 refs. [Pullman, Wash.] 1955.

The following is based almost entirely on the author's summaries. *Oligonychus* (*Paratetranychus*) *pratensis* (Banks) was first described from Washington State in 1912 and is now a pest of cereals and other grass crops in wide areas of the western United States. All stages of this mite are described, and observations on its bionomics and control in Washington, made mainly in 1953, are recorded. It was found to attack a wide range of grasses, preferring the broad-leaved and more succulent species. When the mite was reared on barley in the laboratory, the eggs were laid on the leaves or in existing webbing, and hatched in 4–36 days, depending on temperature, and the larval, protonymphal and deutonymphal stages, including the resting period that follows each, lasted 2–17, 1–13 and 1–18 days, respectively. Development from hatching to adult emergence ranged from a minimum of five days for both sexes to 32 days for males and 37 days for females. The preoviposition period lasted 1–11 days, and the oviposition period ranged up to 71 days, the averages in the different generations varying from 11·1 to 48 days. The numbers of eggs laid per female averaged 61·1 and ranged up to 147, the maximum per female per day being 11. Females survived for up to 75 days, excluding overwintering individuals, and males for up to 95 days. Fertilised females gave rise to 62·4 per cent. females and 37·6 per cent. males in their progeny, and unfertilised ones to males only. The fertilised females overwintered, feeding during warm periods. Seven overlapping generations were reared in 1953, the life-cycle requiring only 2–3 weeks in summer. The mites were attacked by *Hippodamia convergens* (Guér.), *Coccinella transversoguttata* Fald., *Stethorus picipes* Csy., *Typhlodromus fallacis* (Garman) and *T. cucumeris* Oudm.

Experiments on control by means of sprays and dusts were made in 1952–53, and the results are given in detail and discussed. The treatments recommended, and the amounts per acre, are Systox at 6–8 oz. actual toxicant [demeton (diethyl 2-(ethylthio)ethyl phosphorothioate)] in a spray, parathion at 1 lb. in a spray or 0·5 lb. in a 2 per cent. dust, and sulphur at 25 lb. as a dust. Applications should preferably be made in late summer.

Wilcox (J.), Howland (A. F.) & Campbell (R. E.). **Investigations of the Tomato Fruitworm. Its seasonal History and Methods of Control.**— *Tech. Bull. U.S. Dep. Agric.* no. 1147, [1+] 47 pp., 19 figs., 33 refs. Washington, D.C., 1956.

The following is based on the authors' summary. *Heliothis zea* (Boddie) is the most important pest of tomatos in the United States. An account is given of investigations on its bionomics and control begun in 1936 and carried out mainly in southern California, though data from Utah and Ohio are also included.

In California, the percentage of fruits damaged is usually highest at the beginning of the picking season, though it reaches a peak towards the end of picking in some years. The eggs are mostly laid on the outer leaves of the plant and hatch in 5–10 days. Some caged females laid more than 1,000 eggs each. There was no relation between the numbers of eggs found on the plants and subsequent larval infestation, but it was possible in Utah to predict the extent of infestation from counts of eggs between 15th July and 1st August. The larval stage lasted 21–44 days in California and 18–51 days in Ohio. Although more than half the population completed their development in 50–75 days, many pupae remained in the soil and overwintered, the period of development then lasting up to 375 days. Adults emerged throughout the year in California, but peak numbers were observed in May–September. The adults survived for 1–29 days, depending on temperature. Few pupae overwintered in Utah, and there was no relation between the numbers that survived and infestation in the following year. The larvae were parasitised by *Hyposoter exiguae* (Vier.) in California and Utah, and the eggs by *Trichogramma minutum* Ril. and the larvae also by *Campoletis perdistinctus* (Vier.) in Utah.

Experiments on control in California are described. In tests during seven years, baits prepared from 1 lb. cryolite and 9 lb. maize meal, applied to the plants three times at fortnightly intervals at a total rate of 180 lb. per acre, gave good control of the larvae and also of cutworms, but were less effective against several other pests of tomato than dusts, which were therefore used in most of the experiments. From 1936 to 1940, cryolite was the most promising material, followed closely by calcium arsenate. Imported synthetic cryolite was superior to domestic synthetic cryolite, and applications with a power duster tended to be less effective than those with a hand duster. Cryolite dusts containing 35, 50 and 70 per cent. sodium fluoaluminate were equally effective when applied at the same rate of fluoaluminate per acre [*cf. R.A.E.*, A **32** 198]. Applications of cryolite and calcium arsenate combined or alternated were not phytotoxic, but cryolite alone was as effective. In tests in 1941–42, in which 70 per cent. cryolite was compared with undiluted calcium arsenate, each applied at total rates of 30, 60, 90 and 120 lb. per acre, calcium arsenate was slightly superior to cryolite, and control was improved significantly with each increase in rate except that between 90 and 120 lb. There was no significant difference between the several diluents used for cryolite dusts, and the addition of mineral oil or soy-bean flour as adhesives or of copper fungicides did not increase their insecticidal effectiveness. Plant size was not important in

timing the treatments, but it was found that the first application should be made when an average of five fruits had set per plant. Three applications were necessary for effective control, and the best results were obtained when they were applied 1, 3 and 5 weeks after fruit-setting.

In tests in 1944–50 [*cf.* **39** 240], DDT was superior to cryolite, lead arsenate and calcium arsenate in dusts. Of the chlorinated hydrocarbons tested, only DDD (TDE) was as effective as DDT, but toxaphene was almost as good. The best results were obtained with DDT when the timing and number of applications were the same as for cryolite. Low-volume sprays were tested in 1950–51, and excellent results were given by DDT alone or with the addition of schradan or parathion and by dieldrin, toxaphene, Metacide [methyl-parathion and parathion] and endrin.

Smith (O. J.), Dunn (P. H.) & Rosenberger (J. H.). **Morphology and Biology of *Sturmia harrisinae* Coquillett (Diptera), a Parasite of the Western Grape Leaf Skeletonizer.**—*Univ. Calif. Publ. Ent.* **10** no. 5 pp. [3+] 321–357, 25 figs., 56 refs. Berkeley, Cal., 1955.

The following is based on the authors' summary. *Sturmia harrisinae* Coq. was introduced into California from Arizona and liberated against *Harrisina brillians* B. & McD. on vines in 1951–53. It soon became the most important of the introduced parasites of this Zygaenid [*cf. R.A.E.*, A **42** 16]. The species is polytypic, and the black form concerned agrees with that described as *S. tuxedo* by Curran. All stages of this Tachinid are described, and an account is given of investigations on its bionomics. These showed that there are usually two generations a year, though 1–3 may occur. The adults are most active in full sunlight, and the two sexes are about equal in numbers. In confinement, males survived for an average of 7 days and females for 13. Eggs were deposited on larvae of *H. brillians* in all but the first instar, about 300 eggs being laid per female. Superparasitism was common in the field. The larva hatches immediately after oviposition, the egg chorion usually being broken by contact with the host integument, and enters the host, ultimately settling in the lumen of a silk gland. When the host pupates, the larva, which is still in the first instar, cuts an air hole and becomes surrounded by a respiratory funnel and completes its development in summer or enters diapause through the winter. Complete larval development in summer lasted about 20 days in nearly mature host larvae and longer in younger ones. The puparia are formed within the host cocoons, and the adults emerged after 9–15 days or longer, depending on temperature. The minimum duration of the life-cycle was 32–35 days. An undescribed species of *Dibrachys* parasitised 24 per cent. of the overwintering parasites at one place in California in 1953. Parasitism of *H. brillians* was nearly 24 per cent. over the infested area at the end of 1953 and over 52 per cent. near the liberation points.

Fronk (W. D.). **An economically important Aphid new to the United States.**—*Pan-Pacif. Ent.* **31** no. 4 p. 190, 3 refs. San Francisco, Cal., 1955.

Myzus ascalonicus Doncaster, which had not previously been observed in the United States, was found among Aphids collected in April 1940 in Wyoming from onion setts sent from Detroit, Michigan. It was first recorded in Britain in 1941 [*cf. R.A.E.*, A **35** 205] and is already known in Canada [*cf.* **44** 228].

Thomas (J. B.). **Notes on Insects and other Arthropods in Red and White Pine Logging Slash.**—*Canad. Ent.* **87** no. 8 pp. 338–344, 16 refs. Ottawa, 1955.

The insects and other arthropods associated with the stumps and tops of white and red pine (*Pinus strobus* and *P. resinosa*) left after felling operations begun in late October 1949 were studied in Quebec during 1950 in a mixed coniferous forest, in which these two trees were dominant. About 140 species, mostly insects, were found, and those that were sufficiently numerous to form a definite part of the complex are shown in four lists, in which they are classified according to whether they bore in phloem or sapwood, feed on fungi, frass or detritus, or are predacious or parasitic, with notes on their habitats and, where relevant, other species with which they were associated.

Neilson (W. T. A.). **Sawflies collected from Low-bush Blueberry Fields in New Brunswick (Hymenoptera: Tenthredinidae).**—*Canad. Ent.* **87** no. 8 pp. 356–357, 1 ref. Ottawa, 1955.

A list is given of 19 sawflies swept from the vegetation in fields of low-bush blueberry (*Vaccinium* spp.) in Charlotte County, New Brunswick, in 1950–53. Only three of them, *Neopareophora litura* (Klug), *Pristiphora* sp. and *P. idiota* (Nort.) feed on blueberry.

Lafrance (J.) & Perron (J. P.). **Composite Emergence Cage for Studies on the Life-history of the Onion Maggot, *Hylemya antiqua* (Mg.) (Diptera: Anthomyiidae).**—*Canad. Ent.* **87** no. 8 pp. 358–362, 5 figs. Ottawa, 1955.

Details are given of the construction of a cage found satisfactory for collecting adults of *Hylemyia antiqua* (Mg.) emerging from the soil. It has a removable top into which the adults are attracted by light and from which they can be transferred to a portable collecting cage, which is also described, and there is a tray base that can be sunk into the soil and used as a container for pupae buried in autumn or for growing onion plants in spring, the upper unit being fitted on when emergence is due.

Salt (R. W.). **The Concept of Survival in Preference to that of Mortality.**—*Canad. Ent.* **87** no. 9 pp. 380–382, 1 ref. Ottawa, 1955.

The effect of exposing insects to an insecticide or any other adverse agent is usually assessed as the observed mortality after an arbitrarily selected interval, but this disregards the subsequent fate of the survivors. Sublethal treatment causes effects that vary in permanence and severity, but may be sufficient to inhibit the major developmental changes. This was confirmed by observations on the effect of chilling on eggs of *Oncopeltus fasciatus* (Dall.) [*R.A.E.*, A **44** 404] and, in the author's own work, on the immature stages of *Cryptolestes* (*Laemophloeus*) *ferrugineus* (Steph.). Arbitrary mortality counts may be adequate for some comparative purposes, but survivors should be considered for determination of the relative effectiveness of different dosages, since the potentialities for effective reproduction of insects that survive high and low dosages will be different.

Harcourt (D. G.), Backs (R. H.) & Cass (L. M.). **Abundance and relative Importance of Caterpillars attacking Cabbage in eastern Ontario.**—*Canad. Ent.* **87** no. 9 pp. 400–406, 1 graph, 7 refs. Ottawa, 1955.

The following is based on the authors' summary. An analysis of the complex of Lepidopterous larvae found attacking cabbage at Ottawa in 1951–54 showed that the decreasing order of abundance was *Pieris rapae* (L.), *Plutella maculipennis* (Curt.) and *Trichoplusia ni* (Hb.) on early crops and *Plutella*, *Pieris* and *Trichoplusia* on late ones [*cf. R.A.E.*, A **42** 52]. In general, *Pieris* was the most abundant species during June and July, after which a highly contagious larval disease prevented further increase, and *Plutella* during August–October, after which the population was reduced by cool weather and parasites, chiefly *Diadromus plutellae* (Ashm.) and a species of *Angitia* (*Horogenes*) near *plutellae* (Vier.). *Trichoplusia* at no time formed a significant part of the complex on either crop. Laboratory studies indicated that the feeding ratio (calculated from the relative amount of food ingested per larva and the mean number of generations per year) of equal populations of larvae of *Plutella*, *Pieris* and *Trichoplusia* is 1 : 7·5 : 11·6. The mean percentages of the total consumption of foliage attributable to each of the species for the four years under review were about 13, 85 and 2, respectively, on early cabbage and about 26, 66 and 8 on late cabbage.

Loschiavo (S. R.). **Mortalities of Males and Females of** *Tribolium confusum* **Duv. (Coleoptera: Tenebrionidae) exposed to residual Deposits of** *p,p'*-**DDT.**—*Canad. Ent.* **87** no. 9 pp. 407–410, 1 graph, 11 refs. Ottawa, 1955.

In view of the observed differences in susceptibility to insecticides between males and females of various insects [*cf. R.A.E.*, A **42** 253–4; B **30** 194; **42** 71], the relative susceptibility of males and females of *Tribolium confusum* Duv. to DDT residues was investigated in the laboratory. Test insects were reared and kept under conditions similar to those already described [**45** 175], and the two sexes were confined for testing separately in groups of 50 on glass plates that had been sprayed with a solution of 5 per cent. p,p'DDT in benzene at 1 ml. per 100 sq. cm. When the beetles were exposed for two hours six weeks after emergence, mean mortality 64 hours later was 3·5 times as great among females as among males. No mortality occurred among females after 48 hours or among males after 90; 3 per cent. of the males died between 48 and 90 hours after treatment. In a further test, adults less than three weeks old showed significantly greater variation in mortality than those 3–6 weeks old, irrespective of sex. The total mortality two and seven days after treatment of month-old females exposed for three hours at five temperatures between 16 and 32°C. [60·8 and 89·6°F.] was significantly higher than that of males, and the combined mortality for the two sexes two days after treatment increased significantly with rising temperature. Untreated insects showed no mortality, and it is therefore considered unlikely that mortality among treated females was increased by the production of a self-toxic substance [*cf.* **28** 199].

Bennett (F. D.). **Encyrtidae from Trinidad, B.W.I. I. Three Species of** *Pseudaphycus* **reared from Mealybugs.**—*Canad. Ent.* **87** no. 9 pp. 413–416. Ottawa, 1955.

Two of the Encyrtids recorded in this paper from Trinidad are described as new. They are *Pseudaphycus dysmicocci*, which is a solitary parasite of the second-stage nymphs of *Dysmicoccus brevipes* (Ckll.) on pineapple

and is described from the females only, and *P. ferrisianae*, which emerged from *Ferrisiana virgata* (Ckll.) on cacao and which attacks the mealybug from the second stage onwards, up to 20 adults emerging from a single host and females being about four times as numerous as males. *P. ferrisianae* was sent to the Gold Coast for testing against mealybug vectors of cacao viruses in 1953, and trials there and elsewhere indicated that it is specific to *F. virgata*. The other species dealt with is *P. utilis* Timb. [*cf. R.A.E.*, A **26** 586; **32** 342], which was reared from *Nipaecoccus nipae* (Mask.) on cacao in January and April 1955 and is recorded from Trinidad for the first time.

Wolcott (G. N.). **Entomología económica puertorriqueña.** [The economic Entomology of Porto Rico.]—*Bol. Estac. exp. agric. P.R.* no. 125 (1955), 208 pp., 1 pl., 133 figs. Río Piedras, P.R. [1956.] (With a Summary in English.)

This revised version of an earlier bulletin [*R.A.E.*, A **13** 87] contains notes on appearance, bionomics and control of the insects and mites that attack crops in Porto Rico, arranged under the plants concerned, the insects that infest stored products, and the termites that injure trees, structural timbers and articles made of wood.

Smith (K. M.) & Lauffer (M. A.). Ed. **Advances in Virus Research. Volume III.**—$9\frac{3}{4} \times 6$ ins., ix + 338 pp., illus., many refs. New York, N.Y., Academic Press Inc.; London, Academic Books, Ltd., 1955. Price $8 or £3 4*s*.

This further volume of a series comprising critical reviews of research on viruses [*cf. R.A.E.*, A **44** 139] contains two such reviews that are primarily of entomological interest. The first, by K. M. Smith (pp. 199–220, 7 figs., 45 refs.), is a survey of work on the morphology and development of viruses that are pathogenic for insects, including notably polyhedral viruses of the nuclear and cytoplasmic types and the granuloses or capsular diseases, and the second, by K. Maramorosch (pp. 221–249, 1 fig., 84 refs.), is a review of knowledge on the multiplication in their insect vectors of plant viruses transmitted by Cicadellids, with a brief consideration of the possibility of such multiplication in the case of plant viruses transmitted by other arthropods.

Blunck (H.). Ed. **Tierische Schädlinge an Nutzpflanzen. 2. Teil.** [Animal Pests of Economic Plants. Part 2.]—Sorauer (P.). *Handb. Pflanzenkr.* **5,** 5. Aufl., 4. Lief., [7+] 577 pp., 258 figs., many refs. Berlin, P. Parey, 1957. Price *DM.* 147.

This is the fourth part of the enlarged fifth edition of the fifth volume of Sorauer's textbook and contains the sections on Aphids and Coccids, thus completing the Hemiptera [*cf. R.A.E.*, A **44** 209]. The section on Aphids (pp. 1–402) is by the late C. Börner and K. Heinze and was completed, except for minor additions, in 1954. That on the Coccids (pp. 403–520) is by H. Schmutterer and W. Kloft, except for the genus *Quadraspidiotus*, which is dealt with by M. Lüdicke. It is pointed out by the editor in his introduction that, although the text has been kept as concise as possible, these two groups now require more than twice the number of pages that was devoted to them in the preceding edition [**20** 48].

Bess (H. A.). **Ecological Notes on** *Lamprophorus tenebrosus* **(Walker) (Coleoptera: Lampyridae), an Enemy of the Giant African Snail.**—*Proc. Hawaii. ent. Soc.* **16** no. 1 pp. 24–29, 4 refs. Honolulu, 1956.

Larvae of *Lamprophorus tenebrosus* (Wlk.), which prey on *Achatina fulica* in Ceylon [*cf. R.A.E.*, A **12** 269], were collected there and sent to Hawaii, Indonesia and Guam in 1954–55 for the control of that snail, and the author reviews the bionomics and ecology of the predator from the literature [*cf. loc. cit.*] and his own observations in Ceylon. It appeared to be most numerous in the hill country round Kandy and Peradeniya. Adult males and females are probably present throughout most of the year and live for about two weeks and 2–3 months, respectively. Breeding and development are probably continuous, though both *Achatina* and *Lamprophorus* remain inactive during prolonged droughts, so that the life-cycle of *Lamprophorus* may last more than a year in some areas [*cf. loc. cit.*]. Although the larvae are active only at night, they were found more readily during the day, when they coil up in the litter or remain partly within snail shells, apparently still feeding. Rain seemed to stimulate activity, and most larvae were found immediately after rain that followed several days of dry weather; during extended dry periods, the larvae entered the soil and were more difficult to find. They were collected most easily in cacao plantations near Pallekelle, where *A. fulica* was abundant, the soil was a moist sandy loam and the trees were growing well, and were scarce in neighbouring areas on poorer and drier sites, even though *A. fulica* was common.

Nishida (T.). **An experimental Study of the Ovipositional Behavior of** *Opius fletcheri* **Silvestri (Hymenoptera: Braconidae), a Parasite of the Melon Fly.**—*Proc. Hawaii. ent. Soc.* **16** no. 1 pp. 126–134, 3 figs., 13 refs. Honolulu, 1956.

As the extent of parasitism of *Dacus cucurbitae* Coq. by *Opius fletcheri* Silv. in Hawaii has been found to vary with the food-plant of the former, the causes of this variation were investigated in the laboratory. Vials containing ground plant tissue or full-grown larvae of *D. cucurbitae* or both were covered with organdie and exposed in cages containing gravid females of *O. fletcheri*, and the parasites that congregated on the vials were counted 5–60 minutes later. The results showed that the parasites were attracted to the vials containing plant material, regardless of the presence of larvae, and not to those containing larvae only. When newly emerged males and females were similarly tested, the females were not attracted to the vials until they were 4–5 days old, after which the numbers attracted remained nearly constant for 22 days; as the preoviposition period is about three days, it appears that egg development and attraction to the medium are closely associated. There was no evidence that males were attracted to any of the media. Comparison of different media showed considerable differences in the degree of attraction; stem tissues were more attractive than fruit tissues of cucumber, watermelon, pumpkin and even tomato, of which the stem is not attacked by *D. cucurbitae*, and fruit tissues of pumpkin were more and those of tomato less attractive than those of cucumber, watermelon, bitter melon (*Momordica charantia*), balsam apple (*M. balsamina*), bell pepper (*Capsicum*) and papaya. The parasites made no attempt to deposit eggs in plant material containing no *Dacus* larvae, indicating that oviposition is stimulated only by the presence of the latter. Females were equally attracted to material containing larvae of *D. cucurbitae*, *D. dorsalis* Hend., *Musca domestica* L. and *Atherigona excisa* (Thoms.). Oviposition was attempted in larvae of the first three but not in those of the last, which are

considerably smaller, though eggs were actually deposited only in *D. cucurbitae* and *D. dorsalis*.

Sherman (M.) & Tamashiro (M.). **Biology and Control of** *Araecerus levipennis* **Jordan (Coleoptera: Anthribidae).**—*Proc. Hawaii. ent. Soc.* **16** no. 1 pp. 138–148, 2 figs., 13 refs. Honolulu, 1956.

Leucaena glauca is of value as a forage crop in Hawaii, and the seeds are used in the manufacture of local jewellery. It was not attacked by insects until 1944, but a beetle, later identified as *Araecerus levipennis* Jordan, which is widely distributed in the Oriental region, was found damaging a large proportion of the seeds in that year. The Anthribid is now abundant throughout Oahu, where it sometimes attacks almost all the pods in a stand, and it has also been found in the islands of Maui, Kauai and Hawaii. The eggs are deposited in fully grown green pods containing swollen seeds, the fertilised female boring a hole through the pod and depositing 1–3 eggs beside a seed. The larva feeds on the seed, boring into it after a day or so, consumes the entire contents and pupates within the seed coat. All the seeds in a pod may be infested. In the laboratory, the egg, larval and pupal stages lasted 3–7, 27 to over 211 and 6–11 days, respectively. The adults lived for about 13–22 days and fed on pods and pedicels, but caused no important injury.

The development of the larvae was retarded and many were found dying or dead in dry pods with hard seeds, and a predacious mite, *Pediculoides* (*Pyemotes*) *ventricosus* (Newp.) was observed feeding on larvae, pupae and teneral adults in such pods. A few examples of *Eupelmus cushmani* (Crwf.) were reared from infested seeds. Control by spraying with insecticides would be impracticable, unless *L. glauca* is grown in groves. When mature green seeds from infested pods were dipped in slurries and then dried and stored for six months, those treated with 0·001 per cent. lindane [almost pure γ BHC] or 0·05 per cent. aldrin or dieldrin from emulsion concentrates showed no evidence of feeding, whereas feeding continued in seeds treated with 0·25 per cent. wettable DDT or 0·1 per cent. malathion from an emulsion; 27 per cent. of the untreated seeds were infested. Boiling the green seeds for 10–180 seconds killed the larvae in them but prevented natural browning. Bagging clusters of young ripening pods with polyethylene bags punctured with small holes permitted normal development of the seeds and prevented infestation, but paper bags proved unsatisfactory.

Zimmerman (E. C.) & Fletcher (D. S.). *Heliothis* **in Hawaii (Lepidoptera: Phalaenidae).**—*Proc. Hawaii. ent. Soc.* **16** no. 1 pp. 170–176, 3 figs., 10 refs. Honolulu, 1956.

Records of *Heliothis armigera* (Hb.), or of synonyms of it, in Hawaii made before about 1930 are shown to refer to *H. hawaiiensis* Quaint. & Brues, which has long been present there, is polyphagous but not a pest of maize or cotton and is here raised to specific status, whereas those made later refer to *H. hawaiiensis* or to *H. zea* (Boddie) [*cf. R.A.E.*, A **44** 385], which was evidently introduced about 1930 and subsequently caused severe injury to maize [*cf.* **20** 225–226]. The true *H. armigera* is not present. *Heliothis* is a complex containing many similar forms that are often difficult to separate by external characters. The two species found in Hawaii are most easily differentiated by characters of the aedeagus, and a key is given to facilitate their separation. *H. hawaiiensis* is externally similar to *H. zea*, but its aedeagus appears most closely to resemble that of *H. gelotopoeon* (Dyar) from South America [*cf.* **44** 385]. The food-plants and natural

enemies of each species in Hawaii have not yet been accurately determined. A record of *H. inflata* (Wllgr.) in Hawaii is stated to be incorrect; this species occurs in Central and South America and the Galapagos Islands.

Frappa (C.). **Sur l'importance du parasitisme du Mymaridé** *Anaphoidea nitens* **Guer. vis-à-vis du charançon de l'eucalyptus** *Gonipterus scutellatus* **Gyll. dans la région de Tananarive.**—3 pp., 3 refs. [*Sine loco*, ?1955.]

Infestation of *Eucalyptus* by *Gonipterus scutellatus* Gylh. in Madagascar, which was first observed near Périnet, in the east, in 1948–49 [*cf. R.A.E.*, A **40** 287], had spread by 1953 to the district of Tananarive. Egg-pods of the weevil collected in February–August 1954 were observed in the laboratory to determine the extent to which the introduced parasite, *Anaphoidea nitens* Gir. [*loc. cit.*], had followed its host. Some 77 per cent. of the egg-pods were found to be parasitised by it, and the numbers of parasites that emerged per pod averaged 5·8, 5·4, 2, 3·2, 4 and 6·5 in February, March, April, May, June and July–August, respectively. The maximum per pod was 19. At Périnet in 1954, 65–75 per cent. of the egg-pods were parasitised.

Ossowski (L. L. J.). **A Guide to the Assessment of Wattle Bagworm Infestations.**—8 pp., 8 pls. (7 col.). Pietermaritzburg, S. Afr. Wattle Gr. Un., 1956.

The author describes the life-history of *Acanthopsyche junodi* (Heyl.) on wattle (*Acacia*) in South Africa and gives coloured plates enabling seven degrees of infestation to be distinguished from the appearance of the trees. The adult male and the bags formed by the males and females are illustrated on another plate.

Goodman (A.) & Toms (A. M.). **Effect of Rainstorms upon the Cotton Jassid in the Sudan Gezira.**—*Nature* **178** no. 4530 p. 436, 2 refs. London, 1956.

Rainstorms on three occasions in September–October 1955 were followed by reductions in numbers of *Empoasca lybica* (de Berg.) on cotton in the Gezira area of the Sudan [*cf. R.A.E.*, A **38** 477], and the differences were shown in some cases to be significant. In one of the areas affected, the population had increased again by November.

Joyce (R. J. V.). **Some Observations on the Effect of Insecticides on the Growth of Cotton Plants.**—*Emp. Cott. Gr. Rev.* **32** no. 4 pp. 266–273, 3 refs. London, 1955.

The control of *Empoasca lybica* (de Berg.) on cotton in the Sudan Gezira by means of DDT has been accompanied by a decline in the quality of the cotton picked [*cf. R.A.E.*, A **43** 442], and it has been suggested that the DDT sprays improve vegetative growth but delay fruiting. Preliminary investigations during the season of 1952–53 suggested that when the population of *Empoasca* is small, the effect of the DDT is to increase leaf size and the number of leaves per plant, possibly producing a more vegetative plant, and to accelerate rather than delay fruiting and the maturation of the crop. In experiments in 1953–54, spraying with parathion did not appear to

stimulate vegetative growth, but the small differences found between the growth of plants treated with parathion and those left unsprayed were consistent with the view that this treatment also accelerated fruiting and crop maturation. This may, however, have been due to a partial control of the cotton whitefly [*Bemisia tabaci* (Gennadius)].

McDermid (E. M.). **The Insect Pests of Cotton in Zande District of Equatoria Province, Sudan. 1. The Cotton Plant in Zande District.** —*Emp. Cott. Gr. Rev.* **32** no. 4 pp. 256–265, 3 graphs, 4 refs. London, 1955. **2. The Insect Pests, their Status and Control.**—*Op. cit.* **33** no. 1 pp. 44–66, 1 fig., 23 refs. 1956.

In the first part of this paper, an account is given of the conditions under which cotton is grown in the Zande district of Equatoria Province, in the south-western Sudan, where a development scheme is in operation. At the research station at Yambio, which was established in 1948, the cotton is sown as soon as possible after 1st June and harvested from late October to the beginning of January, but the peasant cultivators sow from early June to August and pick the crop between December and early March. Rainfall has the greatest effect on yield, but plot tests showed that protection from insects gave significant increases in yield of high-grade cotton.

The insect pests of cotton in the district are reviewed in the second part. The only major pests are *Dysdercus* spp., particularly *D. superstitiosus* (F.), and bollworms, and information is given on the bionomics, seasonal history, injuriousness and alternative food-plants of these and of *Helopeltis schoutedeni* Reut. [*cf. R.A.E.*, A **41** 15], which is present on the crop in small numbers throughout the season. *D. superstitiosus* forms 95 per cent. of the stainer population and damages both lint and seed. It appears towards the end of September and begins to leave the crop in mid-November, completing 2–3 generations on it and increasing greatly in numbers. Alternative food-plants are numerous, notably *Sterculia setigera*, on which development occurs throughout the year. The bollworms present are *Platyedra gossypiella* (Saund.), *Earias insulana* (Boisd.) and *Heliothis armigera* (Hb.), of which only the first is of major importance, causing a crop loss of about 27 per cent. Except at the beginning of the season, bolls are more heavily attacked by *P. gossypiella* than are buds, and most of the feeding is on ripe or developing seeds. Larval diapause either does not occur or is very rare, and the main alternative food-plant is *Hibiscus esculentus*.

DDT and BHC are effective against the insects that feed externally, and it is thought that the application of these, together with the rigid enforcement of standard field hygiene against *Platyedra*, should result in increases of 45–55 per cent. in the yield of saleable cotton. Improved cultivation is the first necessity, however.

Fidler (J. H.) & Webley (D. P.). **Seed Dressings for the Control of Frit Fly in Oats.**—*Nature* **178** no. 4548 p. 1480, 3 refs. London, 1956.

In view of the good control of *Hylemyia* (*Leptohylemyia*) *coarctata* (Fall.) on wheat given by seed dressings [*cf. R.A.E.*, A **44** 260], the systemic effect of BHC applied to the roots of cereal seedlings [*cf.* **44** 307], and the large proportion of the eggs of *Oscinella frit* (L.) that are laid in the soil round the plants under dry conditions, the effect of applying insecticidal dressings to oat seed for the control of *O. frit* was investigated in Wales in

1956. Seed that had already received an application of an organic mercurial dressing was treated with γ BHC, aldrin or dieldrin at 0·6, 1·2 and 2·4 mg. per gm. and sown on 26th April in experimental plots. Examination of plants on 25th June, when infestation was at a maximum, showed that excellent control had been obtained on the primary shoots, which are of major importance in grain production by late-sown crops, especially from the higher rates of application. The percentages of primary shoots infested in plots treated with aldrin, dieldrin and γ BHC at 2·4 mg. were reduced from 94 to 24, 20 and 28, respectively, and the yields subsequently obtained amounted to 18, 18·1 and 9·7 cwt. per acre. The lower dosages were much less effective, except for dieldrin at 1·2 mg., which resulted in 16 per cent. infestation of primary shoots and a yield of 17·8 cwt. per acre. No yield was obtained from the control plants. Germination of the treated seed was reasonably good. In a further trial, seed treated with γ BHC and dieldrin at 2·4 and 4·8 mg. per gm. was sown on 6th July. The results given by dieldrin were similar to those in the earlier test; γ BHC severely damaged the plants at both rates. The seed was sown at a depth of about an inch in both tests, and seed treatment might prove less effective against larvae hatching near the soil surface if the depth were much increased.

Collyer (E.) & Groves (J. R.). **Some Tetranychid Mites on Fruit Trees.** —*43rd Rep. E. Malling Res. Sta. 1954–55* pp. 135–138, 14 refs. East Malling, 1956.

A key, based on the habits of the mites and external features that can be seen with a hand lens, is given for the separation of *Metatetranychus ulmi* (Koch), *Tetranychus telarius* (L.), *T. viennensis* Zacher (*crataegi* Hirst), *Eotetranychus carpini* (Oudm.), *Bryobia praetiosa* Koch and *Brevipalpus geisenheyneri* (Rübs.), all of which occur on fruit trees in south-eastern England, together with notes on the morphology, bionomics and food-plants of the last four, as observed in recent years.

Kangas (E.). *Dendromyza cerasiferae* **n. sp.** (**Dipt., Agromyzidae**) **from England.**—*Ann. ent. fenn.* **21** no. 4 pp. 165–170, 3 figs., 13 refs. Helsinki, 1955.

Pitcher (R. S.). **A further Note on a Cambium Miner of** *Prunus* **spp.** (*Dendromyza cerasiferae* **Kangas, Agromyzidae, Dipt.**).—*43rd Rep. E. Malling Res. Sta. 1954–55* pp. 139–140, 6 refs. East Malling, 1956.

A species of *Phytobia* (*Dendromyza*) found mining in the cambium of plum and other species of *Prunus* at East Malling [*cf. R.A.E.*, A **42** 189] is described in the first paper from adults of both sexes as *Dendromyza cerasiferae*, sp.n. In the second paper, notes are given on the appearance of the immature stages of *P. cerasiferae* and on its bionomics, based on observations in 1952–54. In an unheated insectary, eggs were inserted into one-year-old wood from 27th June to 8th July, usually singly, but sometimes in groups of up to four. The larvae fed from July to May in the cambium, mainly of wood that was 2–4 years old, and pupated in the top inch of soil between mid-May and late June. Adults emerged from 20th June to 22nd July and lived for 4–5 days. The Braconid, *Symphya mandibularis* (Nees), emerged from about 80 per cent. of the pupae, adults appearing from 25th June to 22nd July; it probably attacks the eggs or very young larvae, which are only thinly covered.

Briggs (J. B.). **Notes on the Biology and Identification of some Allies of the Winter Moth** (*Operophtera brumata* (**L.**)).—*43rd Rep. E. Malling Res. Sta. 1954–55* pp. 141–145, 1 pl., 1 fig., 8 refs. East Malling, 1956.

A summary is given of the results of observations on Geometrids that infest fruit trees, notably apple, in association with *Operophtera brumata* (L.), made at East Malling in 1952–54. The species considered are *O. fagata* (Scharfenb.), *Alsophila aescularia* (Schiff.), *Phigalia pilosaria* (Schiff.), *Erannis progemmaria* (Hb.), *E. aurantiaria* (Esp.), *E. defoliaria* (Cl.), *E. leucophaeria* (Schiff.), *Apocheima hispidaria* (Schiff.) and *Theria rupicapraria* (Schiff.). The habits of these moths are described, and notes are given on the bionomics of all but the last three. Damage was practically negligible in orchards receiving a pre-blossom application of DDT, and there is no evidence that larvae, such as those of *Alsophila*, that hatch later than those of *O. brumata*, are not controlled by modern spray programmes. Characters of the eggs are shown in a table, and a key is given to the apterous females of all ten species, followed by one to the full-grown larvae of these and related moths found on fruit trees.

Tew (R. P.) & Groves (J. R.). **Some Field Experiments upon the Control of Codling Moth, *Ernarmonia pomonella* (L.), by organic Insecticides.** —*43rd Rep. E. Malling Res. Sta. 1954–55* pp. 146–148, 7 refs. East Malling, 1956.

In tests in which 0·2 per cent. lead arsenate, 0·1 per cent. wettable DDT, 0·05 per cent. wettable 2,4-dinitro-6-(1-methylheptyl)phenyl crotonate [previously known as dinitrocaprylphenylcrotonate], 0·1 per cent. toxaphene and 0·05 per cent. aldrin or dieldrin (these last three in emulsion concentrates) were applied in sprays to apple in southern England against a light infestation of *Cydia* (*Enarmonia*) *pomonella* (L.) on 9th July 1951, and toxaphene, lead arsenate and DDT against a heavy one on 16th June 1952, only DDT significantly reduced damage by the larvae. Counts of eggs and active stages of *Metatetranychus ulmi* (Koch) on 16th July 1951 showed significantly lower populations of the latter after treatment with the crotonate, and similar counts on 18th July 1952 showed increased populations due to all treatments, the increases being greatest for DDT and least for lead arsenate. The addition of 0·05 per cent. of an adhesive of the polyethylene polysulphide type did not affect the performance of toxaphene in 1952.

Tew (R. P.) & Gambrill (R. G.). **The Fruit Tree Red Spider Mite, *Metatetranychus ulmi* (Koch): a further Pilot Trial in the Field of two Ovicides applied to Apples at Pink Bud.**—*43rd Rep. E. Malling Res. Sta. 1954–55* pp. 149–150, 2 refs. East Malling, 1956.

In further investigations on the control of *Metatetranychus ulmi* (Koch) on apple in south-eastern England [*cf. R.A.E.*, A **44** 20], the examination on 1st March 1954 of trees sprayed with three chlorinated phenyl benzenesulphonates [4-chlorophenyl 4-chlorobenzenesulphonate, 4-chlorophenyl benzenesulphonate and 2,4-dichlorophenyl benzenesulphonate] in 1953 [**44** 21] showed relatively high levels of winter-egg density on treated trees but significantly lower ones on the unsprayed trees, which had suffered severe bronzing during the summer of 1953.

In 1954, sprays of 0·1 and 0·05 per cent. wettable 4-chlorophenyl 4-chlorobenzenesulphonate and 4-chlorobenzyl 4-chlorophenyl sulphide were applied

at the pink-bud stage, on 30th April, and counts on 14th June showed that very few mites were present on treated trees. Statistical analysis showed no significant difference in effectiveness against active mites between the two compounds, but the higher concentration of each was the more effective; the sulphide resulted in significantly fewer summer eggs than the sulphonate.

Crooke (M.). **Forest Insects in the Gale-damaged Woodlands of north-east Scotland, 1953–1954.**—*Rep. For. Res. 1953–54* pp. 163–169. London, 1955. **Insect Development in the Scottish Gale-damaged Woodlands.** —*Op. cit. 1954–55* pp.59–60. 1956.

It is reported in the first paper that large numbers of pine trees in forests in north-eastern Scotland were blown down in a gale on 31st January 1953. Most of them were Scots pine [*Pinus sylvestris*] more than about 40 ft. in height on private estates, and since it was unlikely that they could be cleared before 1954, an outbreak of *Myelophilus piniperda* (L.) was feared. A survey was therefore carried out from May to September 1953, 33 sample areas, each averaging 163 acres in extent, being visited four times. On each occasion, populations of *M. piniperda* were assessed from the numbers of egg galleries in and under rings of bark at heights of 5–40 ft. from the base on ten trees blown over but not broken off, and on two snapped stems. Owing to the warm spring, many galleries containing eggs were already present when the survey began, and larvae had hatched in some of them. Fresh galleries were made throughout the season, some by females breeding for a second time, and first-generation adults were present from late June. In spite of the favourable spring, a second generation was nowhere completed [*cf. R.A.E.*, A **32** 300]. Breeding in appreciable numbers occurred only in trunks that were severed from the roots, and there was none in standing trees or in fallen ones that retained their roothold, probably because of the osmotic pressure of the sap and, chiefly, the flow of resin from wounds; weather conditions enabled many of the uprooted trees to remain alive, and the flow of resin was therefore maintained. Breeding was thus less extensive than had been feared.

Felled timber provided the only major breeding site for *M. piniperda* other than the snapped trunks, and the value of spraying this with BHC or DDT to provide a deposit toxic to the emerging adults was investigated. In a preliminary test, stacks of heavily infested pit props were sprayed on 2nd June with 0·5, 1 and 3 per cent. DDT or BHC, the first in emulsified solution and the second in wettable powder, at rates of 1 and 2 gals. per 100 sq. ft. of bark surface. Fewer adults emerged from treated stacks than from untreated ones, and the estimated percentage mortality due to treatment, including that occurring up to four days after emergence, ranged from 90·4 to 98·9 for DDT and from 74·5 to 95·6 for BHC. A proprietary BHC emulsion concentrate was more effective than the wettable powder, possibly because the latter tended to clog the spraying equipment. In a field trial, stacks in five forests comprising in all some 65,000 cu. ft. of timber were sprayed during July, when emergence was just beginning, with 2 per cent. DDT at 1 gal. per 100 sq. ft. of bark surface. Both newly emerged and older beetles were affected, and the estimated percentage mortality due to treatment ranged from 75·3 to 99·4. It is pointed out that insecticidal treatment of stacks is justifiable only when the logs are heavily infested by populations nearing maturity, cannot be removed before the main emergence period, and present a hazard to neighbouring plantations.

A brief survey in nine forests in the gale-damaged areas during October 1953 showed that *Hylobius abietis* (L.) and *Hylastes* spp. were breeding

in considerable numbers in stumps from which the trunks had been removed early in the year, but that no breeding occurred in those from which the trunks had only recently been removed. Development was rapid in the susceptible stumps, probably owing to the accelerated drying out of the root system following disturbance, and it was therefore thought that these breeding sites would be quickly exhausted.

In the second paper, which forms part of a report on forest entomology, it is stated that similar surveys were carried out in 1954. In that year, infestation by *M. piniperda* became general as the blown pines began to die off, even though retaining their roots, and standing stems were attacked in two forests. Breeding by *Hylobius abietis* in stumps continued, and the main emergence of young weevils was predicted for 1955.

Bevan (D.). **The Status of the Pine Looper Moth** (*Bupalus piniarius* **L.**) **in Britain in 1953.**—*Rep. For. Res. 1953–54* pp. 158–163. London, 1955.

Crooke (M.). **The Pine Looper Moth,** *Bupalus piniarius.*—*Op. cit. 1954–55* pp. 57–59. 1956.

It is stated in the first paper that investigations on the status in Britain of Lepidoptera that are of importance as pests of pine in continental Europe were begun in 1952. A survey in that year in Thetford Chase Forest (eastern England) showed that *Bupalus piniarius* (L.) was the most abundant species present, that *Panolis flammea* (Schiff.) was common, and that *Lymantria monacha* (L.) was scarce. Populations of *B. piniarius* at Thetford and in Culbin Forest (north-eastern Scotland) were assessed during the winter of 1952–53 by means of counts of pupae in the soil made in plots one yard square, of which five were placed across each forest compartment to be sampled, corresponding to about one plot per five acres. At Thetford, there was in general only 0·1 pupa per sq. yard, but at Culbin there were as many as 6·9 in some compartments. It is considered that pupal populations of 6 per sq. yard are likely to be associated with some signs of feeding on the trees, though general browning of the foliage may not result.

Scots pine [*Pinus sylvestris*] over an area of 100 acres at Cannock Chase (central England) was completely defoliated by *B. piniarius* in 1953 [*cf. R.A.E.*, A **43** 388], and pupal populations in all the main pine-growing areas of England and Scotland were therefore assessed during the winter of 1953–54. In Scotland, they exceeded 6 per sq. yard in five of the 11 forests sampled. At Culbin, the maximum densities were 40·4 under Scots pine 30 years old, 22·5 under Corsican pine [*P. nigra laricio*] 30 years old, and 13·5 under *P. contorta* 24 years old, and densities of at least 15 per sq. yard occurred over almost half the forest area. Populations were usually higher in plots on dunes than in those on shingle beds. No defoliation or browning of the foliage was noted in the autumn of 1953. In England, populations exceeded 6 per sq. yard in four of the 18 forests sampled, but were 9 or less in three of them. At Cannock Chase, where the two defoliated compartments were of Scots pine 33 and 35 years of age, maxima of up to 634 pupae per sq. yard were recorded. Complete defoliation was associated with pupal densities of 150 or more per sq. yard, 50 per cent. defoliation with 80–150 per sq. yard, and slight browning of the foliage with 40–80 per sq. yard. Pupal density was high in and round the two damaged areas, and then fell off gradually to a level of 6–20 per sq. yard; elsewhere it was only 1–2. The percentage parasitism of the pupae at Cannock varied from 10·6 to 33·5 and was lowest in the areas of high infestation. *Ichneumon* (*Cratichneumon*) *nigritarius* Grav., which was the commonest parasite,

attacks larvae in the fifth instar, and since no natural control could be expected before the end of the larval feeding period in 1954, it was proposed to spray the forests at Cannock and Culbin in the summer of that year.

It is reported in the second paper, which forms part of a report on forest entomology, that a spray of 1 lb. DDT in 3 gals. spray liquid per acre was applied from aeroplanes to 2,500 acres of forest at Cannock Chase between 9th August, when just over 80 per cent. of the eggs had hatched, and 28th August, and subsequently over six days to 3,500 acres at Culbin. Counts of dead larvae that fell on to trays set out a few hours after treatment and thereafter at daily intervals showed that mortality was heavy, but this procedure gives an underestimate of effectiveness as many dead larvae fail to reach the ground. Sampling the shoots did not give reliable results, but counts of pupae in the ensuing winter showed densities of 0–1·8 per sq. yard in the treated areas at Cannock Chase and 0–0·8 per sq. yard at Culbin. Comparison of these figures with those obtained in the previous winter showed that the treatment had given very good control. Similar counts in all the forests surveyed in the previous winter showed a general recession in the population of *B. piniarius* in 1954, which is attributable mainly to unfavourable weather.

Hussey (N. W.). **Bioclimatic Studies on the Pine Looper Moth.**—*Rep. For. Res. 1954–55* pp. 80–83, 3 refs. London, 1956.

The temperature and evaporating power of the air in contact with two-year-old needles of Scots pine (*Pinus sylvestris*), on which the eggs and larvae of *Bupalus piniarius* (L.) develop, were investigated during summer and autumn in Britain in view of the existence of some evidence that optimum conditions during the growth stages result in heavier pupae and increased female fecundity. The temperature at the surface of needles in full sunlight and almost perpendicular to the radiation was found to be up to 3°F. above the ambient air temperature, but that of needles shaded from direct sunlight and under clear skies fluctuated from 0·5°F. above the air temperature, when movements of the shading foliage admitted some sunlight, to 1°F. below it. Under heavy cloud, temperatures at the needle surface were slightly higher than those of the air by day and almost identical with them by night, but bright intervals during the day were associated with rapid and often considerable fluctuations, and needle temperature under clear skies at night was 1·5°F. below the air temperature. During rain, the differences between air and needle temperatures were negligible, but evaporation of rain or dew reduced surface temperatures to as much as 2°F. below those of the air for up to an hour. The evaporation rate within 2 mm. of the needle was lower than that in free air within the crown of the tree and lower still than that recorded for free air at a meteorological station, under various conditions of temperature (52–68°F.), relative humidity (45–96 per cent.) and wind velocity (0–700 ft. per minute). In laboratory rearing experiments at these extremes, larvae in the first three instars fed faster under moist conditions, but older ones were not significantly affected; at 100 per cent. relative humidity, all instars fed more rapidly at higher temperatures in the range 36–80°F. Studies on frass production indicated that the larvae feed for about half an hour several times during the 24 hours; heavy frass deposition represents heavy feeding 2½–3 hours earlier. In limited field observations, frass deposition varied by as much as 50 per cent. on successive days, indicating that feeding is influenced considerably by weather. Feeding was much heavier by day than by night under normal conditions, though nocturnal peaks occur at constant temperatures.

Delucchi (V.) & Pschorn-Walcher (H.). *Cremifania nigrocellulata* **Czerny (Diptera, ? Chamaemyiidae), ein Räuber an** *Dreyfusia* (*Adelges*) *piceae* **Ratz. (Hemiptera, Adelgidae).** [*C. nigrocellulata*, predacious on *Chermes piceae*.]—*Z. angew. Ent.* **36** pt. 1 pp. 84–107, 14 figs., 12 refs. Berlin, 1954. (With a Summary in French.)

Delucchi (V.). **Deux espèces nouvelles de** *Pachyneuron* **Walker, parasites de diptères.**—*Bull. Inst. roy. Sci. nat. Belg.* **29** no. 11, 14 pp., 16 figs., 4 refs. Brussels, 1953.

Cremifania nigrocellulata Czerny is a predator of *Chermes* (*Dreyfusia*) *piceae* Ratz. that was introduced into eastern Canada for the control of this Aphid on balsam fir [*Abies balsamea*] in 1952–53 [*cf. R.A.E.*, A **42** 199]. In the first of these papers, the authors describe all its stages and the internal anatomy of the larvae and adults, from which and the chromosome number they consider that its family position in the Diptera is not clear, and give an account of observations on its distribution, bionomics and natural enemies in Europe, begun in 1950.

The species had not been recorded since its description in 1904 from Upper Austria, but it was found to be a common predator of *C. piceae* on *Abies alba* in parts of Switzerland, southern Germany and the Vosges area of France. Overwintering took place in the pupal stage. The adults emerged in numbers from mid-April to the beginning of May, and oviposition continued until the end of May. Mass flight usually occurred during the first fortnight of the month, coinciding with the peak of egg-laying of the host. There was a further small emergence of adults in the second half of June, and a second mass emergence in mid- or late August, at the time of the late summer increase in the host population. Both in the field and in the laboratory, adults lived for 3–4 weeks. The eggs were laid among the egg-masses of *C. piceae*, and the numbers per female are thought to average 50–80, ranging in the laboratory from 15 to 50 at 13°C. [55·4°F.] and from 6 to 203 at 18°C. [64·4°F.]. At 20°C. [68°F.], the egg stage lasted 4–5 days, the three larval instars were completed in 2–2·5, 2·5–3 and 4·5–5 days, respectively, and the prepupal stage lasted 2·5–3·5 days. Actual feeding continued for 8–10 days. Larvae in the first instar fed exclusively on the eggs of *C. piceae*, those containing embryos advanced in development being attacked but soon abandoned. Such eggs did not develop further. Larvae in the second instar, which were able to move to adjacent egg-batches, fed more actively, attacking eggs and neosistentes, and those in the third instar fed on both of these and on sistentes, which had by that time already deposited most of their eggs. These older larvae moved quickly from one egg-batch to another and fed rapidly. Pupation took place in cracks in the bark and other sheltered sites on the trees, but some full-fed larvae dropped to the ground and pupated in the humus layer and some pupated on the unprotected branch surface. When pupae formed in May–June were collected in 1953 in north-eastern Switzerland and kept in conditions resembling those in the field, about 3·5 per cent. of them gave rise to adults after 2–3 weeks, representing the small June flight, 46 per cent. remained in diapause for 2–3 months, giving rise to adults in late summer, and over 50 per cent. continued in diapause well into the winter. The predator was thus well adapted to the life-cycle of its host.

Pupae of *Cremifania* were parasitised by two Pteromalids described in the second paper as *Pachyneuron ferrièrei*, sp. n. [but *cf.* **28** 510], and *P. cremifaniae*, sp. n., and the full-fed larvae by *Lygocerus piceae* (Ratz.). The two former were far less abundant than the latter. *P. cremifaniae* was reared twice only, in 1950, and appeared to be specific to *Cremifania*, whereas *P. ferrièrei* was collected in several localities in 1950–53 and also parasitised *Leucopis griseola* (Fall.) and *L.* (*Leucopomyia*) *obscura* Hal.,

which prey on *Chermes piceae*. The percentage parasitism by *Pachyneuron* spp. was very low. *Lygocerus piceae*, the adults of which are described, was more numerous and also parasitised *Leucopis griseola* and *L. obscura*. The adults were present from May to September.

It was concluded that *Cremifania nigrocellulata* is one of the most effective natural enemies of *Chermes piceae*. It was decided to introduce it into Canada in the adult stage, to avoid the risk of importing its parasites with it, and pupae were therefore collected by placing bands of corrugated cardboard round infested trees and adults reared from them. Some adults were also collected directly from the trees, and 2,200 in all were dispatched by air in special boxes, which are described. Mortality in transit was low.

Scherney (F.). **Ist *Quadraspidiotus schneideri* Bachmann eine Art?** [Is *Q. schneideri* a Species?]—*Z. angew. Ent.* **36** pt. 2 pp. 225–231, 4 figs., 9 refs. Berlin, 1954.

Bachmann (F.). ***Quadraspidiotus schneideri* Bachmann—Art oder Rasse? Eine Entgegnung.** [*Q. schneideri*—a Species or Race? A Reply.]—*Op. cit.* **37** pt. 1 pp. 122–124, 10 refs. 1955.

Zahradník (J.). **Über die wichtigsten artdifferenzierenden Merkmale der Schildlaus *Quadraspidiotus mařani* Zahradník (= *Qu. schneideri* Bachmann).** [The most important Specific Characters of the Coccid, *Q. mařani* (*schneideri*).]—*T. c.* pp. 125–127, 8 refs.

As Bachmann considered that Coccids found on apples imported into Bavaria from Italy and identified as *Quadraspidiotus pyri* (Licht.) were in reality *Q. schneideri* Bachmann, the author of the first paper examined material collected from such fruits mainly from September 1949 to May 1950 and from January to April 1951 in the light of the distinguishing morphological characters specified by Bachmann [*R.A.E.*, A **42** 350]. He concludes from the results, which are set out in detail, that *Q. pyri* and *Q. schneideri* represent the extremes of a continuous series, and that *Q. schneideri* does not merit specific status.

In the second paper, Bachmann summarises from his earlier work [**42** 350] the morphological differences between *Q. schneideri* and *Q. pyri* and agrees that they are slight, but points out that they nevertheless exist and are statistically valid when populations and not individuals are considered. The specific status of *Q. schneideri* is further confirmed by its reproductive isolation from *Q. pyri*, pairing in the two occurring at different seasons [*cf.* **42** 349–351].

The author of the third paper, who considers *Q. mařani* Zahradník to be an earlier name for *Q. schneideri* [*cf.* **42** 350], also describes characters distinguishing this species from *Q. pyri*, points out the difference in overwintering stage, and concludes that the two are specifically distinct.

European and Mediterranean Plant Protection Organisation. *Ceratitis capitata* **Wied. Report of the Second International Conference on Mediterranean Fruit Fly.** [*In English & French.*]—67 pp., 144 refs. Paris, 1957.

This is the report of a conference held at Bonn on 26th–28th September 1956 on the control of *Ceratitis capitata* (Wied.) on *Citrus* and other fruits in countries of the Mediterranean basin. It contains the Report to the Chairman of the Executive Committee of the Organisation, in which suggestions are made for further co-ordinated research, and a report by P. Frézal, who reviews in detail from a personal survey the measures in use or under

investigation for the control of the fruit-fly in various Mediterranean countries. It is shown that, for field control, sprays of DDT are preferred throughout the area. They give good results because of their prolonged residual action and, in the opinion of some, a repellent effect on the adults. Wettable powders are superior to emulsion sprays. Methoxy-DDT (methoxychlor), dieldrin and parathion also give very good control, and the first is used in Israel [*cf. R.A.E.*, A **45** 139], though it is to be replaced by the slightly more effective DDT. The fruit-fly is shown to have few natural enemies in the region, and attempts at their introduction from elsewhere have so far not proved successful.

Pellegrini (G.). **Armi nuove e potenti per la lotta contro la mosca delle olive.** [New and powerful Weapons for the Control of *Dacus oleae*.]—*Ital. agric.* **92** no. 11 pp. 747–754, 4 refs. Piacenza, 1955. **La lotta antidacica ad una svolta.** [The Control of *Dacus oleae* with one Application.]—*Inform. fitop.* **6** no. 16 pp. 261–266, 3 figs. Bologna, 1956.

In view of the risk of the occurrence of toxic residues in oil from olives treated with parathion for the control of *Dacus oleae* (Gmel.), investigations were made in Italy on other organic insecticides that penetrate the fruits but are of low mammalian toxicity. An account is given in the first of these papers of experiments in 1954–55 with O,O-diethyl S-(isopropylcarbamyl)-methyl phosphorodithioate [previously known as O,O-diethyl S-(N-monoisopropyl)acetamido dithiophosphate (*R.A.E.*, A **45** 45)], O,O-dimethyl S-(isopropylcarbamyl)methyl phosphorodithioate and O,O-dimethyl S-(methylcarbamyl)methyl phosphorodithioate. When olives infested by larvae of *D. oleae* were sprayed in the laboratory, the median lethal concentrations of the three compounds were found to be 0·019, 0·014, 0·014 per cent., respectively, as compared with 0·14 per cent. for parathion, and when they were applied at 0·005–0·06 per cent., all gave 80–100 per cent. mortality of the larvae in six days and complete kill in nine days, as compared with no mortality in nine days in untreated olives and 40–90 per cent. in those sprayed with 0·03–0·08 per cent. parathion. In a similar test with dusts, the diethyl compound at 1 and 0·05 per cent. gave 100 and 92 per cent. mortality of the larvae in 3 and 8 days, respectively, O,O-dimethyl S-(methylcarbamyl)methyl phosphorodithioate at 1, 0·5 and 0·025 per cent. gave 100, 100 and 85 per cent. mortality in 2, 2 and 8 days, respectively, and O,O-dimethyl S-(isopropylcarbamyl)methyl phosphorodithioate at 1, 0·5, 0·1 and 0·05 per cent. gave 100 per cent. mortality in 2, 2, 3 and 7 days, respectively. In a further test, all the larvae were killed in two days when a dust containing 0·5 per cent. O,O-dimethyl S-(isopropylcarbamyl)methyl phosphorodithioate was allowed to remain on the surface of the olives for four hours only, though no mortality was given by a 3 per cent. parathion dust under similar conditions. When adults were exposed to surfaces treated with the three compounds at the rate of 0·001 gm. per sq. metre, knockdown was complete or almost complete in 105 minutes and all died within 24 hours.

In field tests, sprays of O,O-diethyl and O,O-dimethyl S-(isopropylcarbamyl)methyl phosphorodithioate at 0·03 and 0·015 per cent. and O,O-dimethyl S-(methylcarbamyl)methyl phosphorodithioate at 0·015 and 0·0075 per cent. were applied in late October to severely infested trees. Samples of olives were picked six days later and kept for emergence of the larvae. The numbers that emerged per 1,000 olives were 0–3 for all treatments, as compared with 13 and 25 for 0·06 and 0·03 per cent. parathion and 287 for no treatment. Further samples were picked 26 days after

treatment with the first two compounds at 0·03 per cent., olives with recent punctures being selected. Microscopic examination 16 days later showed that mortality of eggs and larvae was complete, as compared with 75 and 94 per cent. for 0·06 and 0·03 per cent. parathion and 2 per cent. for no treatment. Further infested trees were sprayed on 23rd September with the diethyl compound at 0·06 per cent. and parathion at 0·04, 0·06 and 0·08 per cent., and the numbers of living larvae per 4,000 olives on 4th January were 2, 166, 135 and 128, respectively, as compared with 140 for no treatment.

The advantages of these compounds for the control of *D. oleae* are briefly discussed. They include the possibility of applying them in dusts or in low-volume sprays in areas where water is scarce, the avoidance of any considerable residues in the oil, since only one application at a relatively low concentration is necessary, and their low mammalian toxicity, all of them being considerably less toxic to mice than parathion.

The results of some of the tests with O,O-dimethyl S-(methylcarbamyl)-methyl phosphorodithioate are also given in the second paper, in which the residues in oil from olives treated with this compound are discussed. Penetration into the olives both from dusts and sprays was very rapid, and the residues in the oil from olives treated at 0·03–0·06 per cent. and 0·3–0·6 per cent. in normal-volume and low-volume sprays, respectively, or at 3 per cent. in dusts in no case exceeded 0·1 part per million.

Antongiovanni (E.). **Lotta contro la tignola dell'olivo con l'impiego della N-monometilammide dell'acido O,O-dimetilditiofosforilacetico.** [Control of *Prays oleellus* with O,O-Dimethyl S-(Methylcarbamyl)methyl Phosphorodithioate.]—*Olivicoltura* 1956 no. 5 repr. 7 pp., 2 refs. Rome, 1956.

The author gives an account of experiments in Tuscany in 1955–56 in which O,O-dimethyl S-(methylcarbamyl)methyl phosphorodithioate and O,O-dimethyl S-(isopropylcarbamyl)methyl phosphorodithioate were tested for control of the leaf-infesting generation of the olive moth [*Prays oleellus* (F.)]. In preliminary tests, the products were applied in emulsion sprays on 7th December to olive trees infested by larvae of the first instar, and the mined leaves were examined on 19th–21st December. The mortality percentages then averaged 10·9 and 23·6 for the second compound at 0·03 and 0·06 per cent., respectively, and 48·7 and 85·1 for the first compound at the same two concentrations, as compared with 0·9 for no treatment. When the first compound was applied on 26th January in a low-volume spray at 0·3 per cent., the percentage mortality of first-instar larvae on 9th February was 48·7, as compared with 5·3 for no treatment. Although parathion had previously given over 90 per cent. mortality of the first-instar larvae when applied at only 0·025–0·05 per cent., tests with O,O-dimethyl S-(methylcarbamyl)methyl phosphorodithioate, which appeared the more effective of the two new compounds, were continued in view of the possibility of applying it in low-volume sprays and in dusts. In these, treatments were applied when half-grown larvae were present in the leaves, and these latter were examined when a few last-instar larvae, which leave the mines and infest the lower surfaces of the leaves, had appeared. The results showed that complete or almost complete mortality of the larvae in their mines was obtained within 12 days with a low-volume spray at 0·6 per cent. and a dust at 3 per cent., as compared with no mortality in the controls. In a further test, with normal-volume sprays, the compound was applied at 0·026, 0·04 and 0·06 per cent. and parathion at 0·013 and 0·026 per cent. on 28th March, rain following. The leaves were examined on 14th–16th

April, and the numbers of half-grown larvae that were living and (in brackets) dead per 11 trees were 21 (96), 6 (103), 3 (179), 141 (227) and 38 (205), respectively, as compared with 849 (49) for no treatment. When the compound was applied on 28th March at 0·4 and 0·6 per cent. in low-volume sprays or at 3 per cent. in a dust, mortality of the larvae in the mines was complete or almost complete two weeks later.

It is concluded that larvae in the second and later instars are more susceptible than those in the first, so that treatments should be applied between the first moult and the beginning of pupation.

DE PIETRI-TONELLI (P.). **Nuovi mezzi di lotta contro la** *Rhagoletis cerasi* **L. con l'impiego di N-dialchilammidi di acidi O,O-dialchiltiofosforil-acetici.** [New Control Measures against *R. cerasi* with O,O-Dialkyl S-(Alkylcarbamyl)methyl Phosphorodithioates.]—22 pp., 7 figs., 33 refs. Montecatini, Soc. gen. Industr. miner. chim., 1956. (With Summaries in English, German and French.) **Contro la mosca delle ciliege, nuovi insetticidi di sicura efficacia.** [The Control of *R. cerasi* with new and efficacious Insecticides.]—*Ital. agric.* **93** no. 1 pp. 49–56, 1 col. pl., 2 figs., 1 ref. Piacenza, 1956.

In the first paper, measures that have been used against *Rhagoletis cerasi* (L.) on cherry are reviewed from the literature, and the results are given of experiments carried out in Italy in 1955 with L 395 (O,O-dimethyl S-(methylcarbamyl)methyl phosphorodithioate), L 396 (O,O-dimethyl S-(isopropylcarbamyl)methyl phosphorodithioate), and L 343 (O,O-diethyl S-(isopropylcarbamyl)methyl phosphorodithioate), designed to test the efficacy of single applications in preventing the hatching of the eggs and the development of the larvae in the fruits. Two types of liquid formulations were developed, with one of which a very high spray deposit was retained on the fruits, and this was therefore adopted for sprays of all three compounds.

Tests on the penetration of the insecticides into the fruits were first carried out with L 395. Penetration was rapid when the compound was applied at either 0·024 per cent. in a spray or 3 per cent. in a dust. The residues in parts per million in the whole fruits and (in brackets) in the pulp alone, determined by bioassay with *Drosophila melanogaster* Mg., were 11·2 (7·4) and 7 (4·2) for the spray and the dust, respectively, after ten hours, 5 and 4 (3·1) after one day, 3·9 (3·3) and 3·9 (2·6) after five days, and 1·5 (1·5) and 1·3 (1·1) after 12 days. When all three products were applied at 3 per cent. in dusts to infested cherries in the laboratory, the percentages containing dead or dying larvae were 20 and 100 after 7 and 26 hours, respectively, for L 395, 70 and 100 after 2 and 7 days, respectively, for L 396, and 100 after 2 days for L 343, as compared with 0–5 in seven days for no treatment.

Field tests were carried out near Modena. The first oviposition punctures were observed in early June and about 6–12 per cent. of the cherries were infested by 14th June. Sprays were applied on 17th June, L 395 being applied at 0·006, 0·012 and 0·024 per cent., L 396 at 0·015, 0·03 and 0·06 per cent. and L 343 at 0·015 and 0·06 per cent. A dust containing 3 per cent. L 395 was applied on 12th June to trees on which about 15 per cent. of the fruits were infested by 11th June. When cherries from the sprayed trees were examined on 20th and 29th June and from the dusted trees on 16th, 18th and 24th June, all the larvae in them were dead, as compared with an average mortality of 0–4 per cent. in fruits from untreated trees. Most of the larvae had been killed in the early instars. The percentage reductions in infestation at normal picking time on 30th June, and (in

brackets) when picking was delayed until 14th July, were 100 (98·7), 100 (98·5) and 96·4 (90) for L 395 at 0·024, 0·012 and 0·006 per cent. in sprays, respectively, 100 (100) for L 395 in the dust, 100 (97·3), 100 (96·8) and 92·8 (89·8) for L 396 at 0·06, 0·03 and 0·015 per cent., and 100 (94·4) and 100 (95·7) for L 343 at 0·06 and 0·15 per cent. Slight traces of the dust were visible on the cherries at picking, but none of the treatments affected the flavour of the fruits. Residues in the fruits at picking were determined only for L 395, and analysis 13 and (in brackets) 26 days after treatment showed that they were about 2 (0·4) parts per million for the dust and 1·4 (0·4), 0·7 (less than 0·3) and less than 0·3 p.p.m. for sprays containing 0·024, 0·012 and 0·006 per cent. toxicant, respectively.

It is concluded that infestation by *R. cerasi* can be controlled by single applications of these products, made when oviposition is first observed, with no risk of harmful residues remaining in the fruits.

The second paper contains a briefer account of the experiments reported in the first.

Frediani (D.). **Notizie sulla *Stilpnotia salicis* L. ed alcuni suoi parassiti ed iperparassiti nella Toscana litoranea.** [Notes on *S. salicis* and some of its Parasites and Hyperparasites on the Coast of Tuscany.]—*Ann. Fac. Agr. Pisa* (N.S.) **16** (1955) pp. 47–53, 4 figs., 13 refs. Pisa [1956]. (With a Summary in French.)

On 8th June 1955, *Stilpnotia salicis* (L.) was observed infesting poplars along a road at Tombolo in the Province of Pisa. Full-fed larvae were found pupating in shelters constructed by webbing together leaves and twigs, and ovipositing adults were also present, emergence having apparently begun in late May. The eggs were laid in groups of 100–500, usually on the trunks and larger branches. By 18th June, many of the eggs had hatched. The larvae fed on the leaves, at first gregariously, and usually on the upper surface, but later singly. Larvae in all stages were observed in July, but the population declined sharply after mid-July and it was not possible to determine the overwintering stage. About 7 per cent. of the eggs were parasitised by *Telenomus mayri* Kieff., and about 80 and 2 per cent. of the larvae by *Apanteles solitarius* (Ratz.) and *Carcelia gnava* (Mg.), respectively. Small numbers of *Dibrachys affinis* Masi and of *Pediobius* (*Pleurotropis*) sp. were obtained from pupae of *A. solitarius*.

di Martino (E.). **L'"acaro delle meraviglie" (*Aceria sheldoni* Ewing) e i relativi mezzi di lotta.** [The "Deformation Mite" (*A. sheldoni*) and Measures for its Control.]—*Riv. Agrumic.* **1** fasc. 3 pp. 119–128, 3 pls. Acireale, 1956.

Malformation of the leaves, buds and fruits of *Citrus*, particularly lemon, has continued to increase in Sicily since 1951, when it was first found to be caused by *Aceria sheldoni* (Ewing) [*cf. R.A.E.*, A **42** 356, etc.]. The injury is described, and it is pointed out that the deformations afford shelter for *Tetranychus telarius* (L.) on the leaves and fruits and *Planococcus* (*Pseudococcus*) *citri* (Risso) on the fruits. In the course of tests against *T. telarius* in 1953–54, the effects of various sprays on *A. sheldoni* were noted. At counts on 31st March, following one treatment on lemon in December, the best results were given by 2 per cent. white mineral-oil emulsion, a mixture of 1 per cent. white mineral oil and 0·03 per cent. parathion, 0·0725 per cent. Chlorobenzilate [ethyl 4,4′-dichlorobenzilate], and 0·2 per cent. of a mixture (Ovomitex) containing 25 per cent. Ovotran [p-chlorophenyl p-chlorobenzenesulphonate] and 25 per cent. Aramite [2-chloroethyl

2-(p-tert.-butylphenoxy)-1-methylethyl sulphite], which reduced the percentages of buds affected from 72·73 for no treatment to 0, 0, 5·71 and 8·57, respectively. On 25th May, none of the buds had been attacked on trees sprayed with the mixture of oil and parathion in December and April or in either one of these months, with 2 per cent. mineral oil in December only or in December and April, or with Chlorobenzilate in December and April or April only. Good results were also given by the mineral-oil spray applied in April only, Ovomitex applied at 0·2 per cent. in December, April or both and Chlorobenzilate applied in December only, the percentages of buds attacked being 1·78–8·26, as compared with nearly 85 for no treatment. The mineral-oil spray is recommended as being the most economical and the least dangerous to use, and it is recalled that applications at 1·75 per cent. in July have also given good control [*cf.* **42** 356]. There was some defoliation when the 2 per cent. spray was applied in both December and April, and treatment in December is therefore preferable. Chlorobenzilate and Ovomitex will give better results when the trees have already resumed their growth, as they are contact poisons. When *T. telarius* is also present, the mixture of Ovotran and Aramite will give good control of both mites.

Planes García (S.). **Memoria de las experiencias realizadas contra el *Earias insulana*, *Platyedra gossypiella* y otras plagas del algodonero. Campaña de 1954.** [An Account of Experiments on the Control of *E. insulana*, *P. gossypiella* and other Cotton Pests. The Campaign of 1954.]—*An. Inst. nac. Invest. agron.* **4** no. 4 pp. 653–703, 7 figs., 10 graphs. Madrid, 1955.

In 1954, infestation of cotton by *Earias insulana* (Boisd.) in southern Spain was generally light until late August and early September. It rose to about 88 per cent. on Egyptian cotton in Valencia by late October, but nowhere exceeded 23 per cent. on irrigated American cotton. Mercury-vapour light traps were set up in four localities to test their value in indicating the necessity of treatments against the larvae. They proved very effective in showing the presence of adults, even when these were not numerous, but there was not always a clear relation between the numbers taken and the subsequent degree of infestation. In general, there was a period of 20–25 days between peak catches and a serious increase in infestation. Attack was reduced in the immediate vicinity of the traps. Cotton was found to be virtually free from *Earias* in an area near Valencia in which the relative humidity was high (75–90 per cent.) from late August to mid-October.

In laboratory experiments on control, larvae were placed on bolls that had been dusted or sprayed with numerous insecticides [*cf. R.A.E.*, A **43** 283]. The best results were given by dusts containing a mixture of 23 per cent. BHC and 35 or 70 per cent. cryolite, which gave complete mortality in 48 hours, and by an emulsion spray of 0·15 per cent. malathion, which gave complete kill in 72 hours. Endrin at 0·15 per cent. and parathion at 0·1 per cent. alone or with 0·25 per cent. DDT gave 95 per cent. mortality in 48 hours. In field tests, sprays of malathion, parathion and Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] gave poor results, and though endrin at 0·15–0·2 per cent. greatly reduced the percentage attack, it was phytotoxic. Sprays of 0·25 per cent. DDT followed by dusts containing a mixture of 23 per cent. BHC and 35 or 70 per cent. cryolite gave good control. Tests on irrigated cotton again showed the effectiveness of mixed dusts of cryolite and sodium fluosilicate [*cf. loc. cit.*]. Though the addition of sulphur to such dusts is of value when *Tetranychus telarius* (L.) is present, it did not increase their effectiveness against *Earias*.

In recent years, *Platyedra gossypiella* (Saund.) has become an important pest of cotton in Spain and the resulting losses in yield have ranged up to 90 per cent. Small-scale experiments on control with organic insecticides were carried out in 1954 in Valencia and Alicante, where attack has been the most severe. Poor results were obtained in Alicante, but in Valencia, where six applications were made between 16th August and 6th October, the percentage of bolls attacked was reduced from 62 to 16 by a wettable-powder spray of 0·125 per cent. DDT and 0·1 per cent. malathion and an emulsion spray of 0·1 per cent. DDT and 0·1 per cent. parathion, and to 11 by a mixture of 0·1 per cent. DDT and 0·1 per cent. Chlorthion, this last giving the greatest increase in yield.

In tests on the effectiveness of methyl bromide for fumigating infested cottonseed, complete mortality of larvae of *P. gossypiella* was given by treatments ranging from exposure for eight hours to 40 oz. per 1,000 cu. ft. at 18°C. [64·4°F.], to exposure for four hours to 75 oz. per 1,000 cu. ft. at 22°C. [71·6°F.] in a small fumigation chamber and by exposure for six hours to doses ranging from 90 oz. per 1,000 cu. ft. at 8°C. [46·4°F.] to 45 oz. at 25°C. [77°F.] in a large one capable of accommodating six trucks of bagged seed at a time.

In a test against *T. telarius*, which occasionally causes severe damage to irrigated cotton, sprays were applied in the field on 28th October. Complete kill of the mites was given in two days by emulsion sprays containing 0·1 per cent. malathion, Chlorthion or parathion, but some eggs survived. Chlorobenzilate [ethyl 4,4′-dichlorobenzilate] at 0·2 per cent. and Chlorocide [p-chlorobenzyl p-chlorophenyl sulphide] at 0·4 per cent. gave inferior results. On 4th November, the plot treated with parathion was still virtually free from living adults.

Santaolalla Azpilicueta (G.). **Estudios sobre la biología y medios de lucha contra la** *Cydia pomonella.* [Studies on the Bionomics and Control of *C. pomonella.*]—*An. Inst. nac. Invest. agron.* **4** no. 4 pp. 711–731, 1 fig., 4 col. graphs. Madrid, 1955.

Observations on *Cydia pomonella* (L.) in north-western Spain in 1954 showed that adults of the overwintered generation emerged between 12th May and 20th August, peak numbers appearing in late June. Beginning on 10th June, 31 apple trees were banded, and 189 larvae (three of which were parasitised) and eight pupae were collected in the bands between 20th July and 11th October; 14 adults emerged, between 5th and 31st August, from which it is concluded that larvae that leave the trees after early August do not give rise to a further generation in the same year.

In experiments on control, the percentage of apples infested, including fallen fruits, was reduced from 57 for no treatment to 6 by sprays of 0·25 per cent. DDT applied on 4th and 24th June and 14th July, or once only on 24th June, 8 by 0·3 per cent. lead arsenate applied on the three dates, and 9 by lead arsenate applied on 4th June, followed by DDT on 14th July. The results were less satisfactory when lead arsenate was applied on 24th June only, or on 14th July only, or when DDT was applied on 14th July only. Lead arsenate frequently caused scorching.

Mathys (G.). **Protection de la faune utile et applications de produits chimiques dans la lutte contre l'araignée rouge de la vigne.**—*Rev. rom. Agric.* **12** no. 1 pp. 3–5, 3 graphs. Lausanne, 1956.

Observations in 1955 confirmed that the increase of populations of *Metatetranychus ulmi* (Koch) on vines in French Switzerland varies inversely

with the frequency of predacious mites of the genus *Typhlodromus* [*cf. R.A.E.*, A **44** 440], of which *T. tiliae* Oudm. is the most important. These predators were found to be active during the winter at temperatures above about 10°C. [50°F.] and they destroyed some of the winter eggs of *M. ulmi* before hatching began. In May, the percentage mortality of *M. ulmi* ranged from 13 on shoots from which *Typhlodromus* was absent to 100 on those with 6–7 individuals; the average mortality was as high as 60 per cent. Counts in summer in a severely infested vineyard showed populations of up to 440 examples of *M. ulmi* per leaf in the absence of mite predators, whereas the numbers rarely exceeded 80 when there was even one individual of *Typhlodromus* per leaf. The population of *Typhlodromus* was very variable and had been too reduced by parathion sprays to control the infestation. Observations on the effects of spray treatments showed that four applications of parathion or zineb [zinc ethylene bisdithiocarbamate] in the course of the season destroyed about 90 per cent. of *T. tiliae* and resulted in increases in populations of *M. ulmi*. Wettable sulphur, copper oxychloride, bordeaux mixture and captan [N-trichloromethyl thiotetrahydrophthalimide] were not injurious to *Typhlodromus*, which maintained control of *M. ulmi*. Spray programmes should therefore be arranged so as to interfere as little as possible with the predator and achieve a natural balance, and suggestions for a suitable programme are given in a table.

Manninger (G. A.). Ed. **A cukorrépakártevők előrejelzése Magyarországon.** [Forecasting of Sugar-beet Pests in Hungary.]—112 pp., 28 figs., 6 fldg. tables, 255 refs. Budapest, Mezőgazd. Kiadó, 1955. Price 11.50 *Ft.*

Apart from an introduction by the editor, in which the economic importance of forecasting outbreaks of agricultural pests is emphasised, this book consists of six main chapters by various authors and a bibliography of the literature on such forecasting published between 1940 and 1st June 1955.

In the first chapter, a brief historical account is given of the development of the forecasting of outbreaks of agricultural pests in Hungary since the initiative taken by Jablonowski in 1906. In the second chapter, which occupies the greater part of the book, detailed information is given on the methods used since 1949 in forecasting the abundance of pests of sugar-beet throughout the country. It is pointed out that forecasting should be based on a thorough study of the biocoenosis of beet fields, and the methods adopted therefore comprise sampling techniques, similar to those used in coenological surveys, for the determination of the abundance of injurious and other organisms that occur at different seasons on the surface of the fields and their surroundings and in the soil at depths down to about 24 ins., supplemented by data on the prevailing cultural, meteorological and ecological conditions. The data are evaluated in the laboratory and used for the compilation of maps showing the abundance of the main beet pests throughout the country, and examples are given of the way in which forecasts are subsequently made for the whole country or for restricted areas. Data are collected during tours made in September–October and again in March–April, during which all the beet farms are surveyed, and it is concluded from similar work in other countries that the accuracy of the forecasts would be improved by making such surveys throughout the year.

The third chapter is concerned with the possibility of forecasting the approximate abundance of beet pests on the basis of meteorological factors alone, by evaluating their effects on the bionomics of the insects. Two methods of correlating meteorological factors and pest abundance are described, and their use in forecasting is shown. In the fourth chapter, the organization of sampling is discussed, and in the fifth, a brief account is

given of some of the effects of cultural practices and meteorological and ecological conditions on the dynamics of animal populations. It is pointed out on the basis of data collected in 1950–54, which are shown in tables, that the most important soil-inhabiting pests of sugar-beet in Hungary are Coleoptera. The only one that is specific is *Cleonus* (*Bothynoderes*) *punctiventris* (Germ.), whereas *Tanymecus palliatus* (F.), *Psalidium maxillosum* (F.), *Melolontha melolontha* (L.), *Rhizotrogus* sp., *Anisoplia* sp., *Agriotes* sp., *Athous* sp., *Opatrum sabulosum* (L.) and *Silpha* (*Blitophaga*) *undata* (Müll.) are polyphagous. Other pests of importance include *Chaetocnema tibialis* (Ill.), *Aphis* (*Doralis*) *fabae* Scop., *Gnorimoschema* (*Phthorimaea*) *ocellatella* (Boyd) [*cf. R.A.E.*, A **45** 205] and cutworms.

In the sixth chapter, the forecasts made since 1951 are reviewed, with brief accounts of the actual occurrence of *Cleonus* and of the damage caused by it, and it is shown that the forecasts proved reasonably accurate.

Missonnier (J.). **Remarques biologiques et essais de traitements chimiques contre la mouche de la betterave** (*Pegomyia betae* **Curt.**).—*C.R. Acad. Agric. Fr.* **41** no. 15 pp. 669–673, 5 refs. Paris, 1955.

Pegomyia hyoscyami var. *betae* (Curt.) causes severe damage to beet in northern France. Near Paris, it has three generations a year and sometimes a partial fourth, adults emerging in early May, in the second ten days of July, during August and in early October. Small numbers of pupae enter diapause in July, and 10, 70 and 100 per cent. do so from 5th August and 1st and 20th September, respectively. The diapause is eliminated only after prolonged exposure to cold during autumn and winter. The first generation, which attacks the seedlings, is the most injurious. The second suffers considerable mortality from high temperatures in July–August, and both the second and third are severely attacked by parasites, the principal species found being the Braconids, *Opius* (*Biosteres*) *spinaciae* Thoms., *O.* (*B.*) *wesmaelii* Hal., *O.* (*B.*) *carbonarius* (Nees) and *O. nitidulator* (Nees), the Cynipid, *Eucoila anomala* Kieff., and the Ichneumonid, *Phygadeuon pegomyiae* Haberm. *Empusa muscae* destroyed large numbers of adults in September 1955 in the lower Seine district. An outbreak of the fly occurred in Normandy in 1954–55, when parasites were scarce.

In tests on the effects of organic insecticides on the immature stages, leaves infested with eggs were sprayed on both surfaces in the laboratory and kept at 20°C. [68°F.], at which temperature the egg stage lasts three days. Examination after five days showed that parathion at 0·015 per cent. in an emulsion spray gave complete mortality of the eggs and that DDT at 0·05 and BHC at 0·1 per cent. in emulsified solutions killed all the larvae as they hatched. DDT and BHC were somewhat less effective in suspensions. In field tests, in which mortality counts were made 4–9 days after treatment, complete kill of the larvae was given by parathion at 0·0105–0·015 per cent. in suspension or 0·015 per cent. in emulsion sprays and by methyl-parathion at 0·015 per cent., lindane [almost pure γ BHC] at 0·03 per cent., and toxaphene at 0·175 per cent. in emulsions and dieldrin at 0·12 per cent. in a suspension and 0·1 per cent. in an emulsion. Inferior results were obtained with these products in dusts (though parathion and methyl-parathion gave 80 and 95 per cent. mortality at 0·8 and 1·2 per cent., respectively), with chlordane in dust or spray, and with DDT and demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] in sprays.

It is recommended that control measures should be applied to young plants when considerable numbers of eggs have hatched and to older ones when the larvae are approaching the end of the second instar.

Roland (G.). **Étude d'une mosaïque de la chicorée de Bruxelles (Witloof)** *Cichorium intybus* **L., var.** *foliosum* **Bishoff.**—*Parasitica* **12** no. 1 pp. 1–7, 2 pls., 5 refs. Gembloux, 1956.

Chicory in an experimental plot in Belgium was found in May 1955 to be infected by a virus causing a yellow mosaic of the leaves. In investigations, it was transmitted to a wide variety of plants by inoculation of sap, and the symptoms caused are described. When *Myzus ascalonicus* Doncaster, *M. persicae* (Sulz.) and *Macrosiphum* (*Aulacorthum*) *solani* (Kalt.) were allowed to feed for 1–2 minutes on infected chicory, following a fast of 2–3 hours, and were then placed successively in groups of five on three series of healthy chicory plants, remaining on these for 1–2 minutes, 1–2 minutes, and 24 hours, respectively, no transmission was obtained with *M. solani*, but *Myzus ascalonicus* and *M. persicae* transmitted the disease to three out of five plants in the first series, two out of five in the second, and none and one out of five, respectively, in the third. No transmission was obtained when the Aphids fed on infected chicory for one hour (after a fast of 2–3 hours) and were left in groups of five for 48 hours on healthy plants, but both species of *Myzus* transmitted the disease to three out of five plants of *Taraxacum officinale* after feeding on infected chicory for 1–2 minutes and, in groups of five, on *Taraxacum* for 24 hours. In a further test, *M. ascalonicus* and *M. persicae* were allowed to feed for 1–2 minutes on infected cucumber and then successively, as in the first test, on three series of healthy chicory plants. The corresponding numbers of plants infected out of five were 2, 1 and 0 for *M. persicae*; no transmission was effected by *M. ascalonicus*.

The symptoms exhibited by tobacco and *Nicotiana glutinosa* inoculated with the chicory virus underwent no modification on further inoculation with the virus of cucumber mosaic, though typical symptoms were produced by the latter on healthy plants of the same species, and in view of this protection and the other properties of the chicory virus, the author considers it to be a variety of cucumber-mosaic virus.

Drees (H.) & Wirtz (W.). **Eine Fliege (***Pegomyia rubivora* **Coquillet) als Himbeerschädling.** [A Fly, *Hylemyia rubivora*, as a Pest of Raspberry.]—*Anz. Schädlingsk.* **28** pt. 10 pp. 152–153, 4 figs., 4 refs. Berlin, 1955.

Hylemyia (*Pegomyia*) *rubivora* (Coq.), which had not previously been recorded as of importance in Germany, was observed in June 1954 injuring raspberry in Cologne. The larvae attacked the tips of the new canes, causing them to wither and die, and bored in the pith. The literature on the bionomics of this Anthomyiid elsewhere is very briefly reviewed [*cf. R.A.E.*, A **22** 362, etc.].

Schimitschek (E.). **Zur Kenntnis des Pappelschädlings** *Pygaera anastomosis* **L. (Lep.—Fam.Notodontidae).** [Contribution to Knowledge of the Poplar Pest, *P. anastomosis*.]—*Anz. Schädlingsk.* **28** pt. 10 pp. 153–156, 8 figs., 6 refs. Berlin, 1955.

Pygaera anastomosis (L.) caused serious injury to poplar in windbreaks of mixed deciduous trees in Burgenland, Austria, in 1955, feeding by the larvae resulting in complete or partial defoliation. Descriptions of the immature stages of this Notodontid and notes on its life-history are given from observations in the laboratory, where complete development of a generation lasted 40 days. No other trees were attacked.

Inouye (M.). **Wichtige, in Hokkaido (Japan) durch schädliche Forstinsekten verursachte Probleme.** [Important Problems caused by injurious Forest Insects in Hokkaido (Japan).]—*Anz. Schädlingsk.* **28** pt. 11 pp. 161–162. Berlin, 1955.

This is a brief survey of the occurrence of insect pests in forests in Hokkaido in 1946–55. Numerous species of bark-beetles infested fallen *Picea jezoensis* following a severe storm in September 1954, *Dendrolimus superans* (Btlr.) injured the foliage of this spruce and *Abies sachalinensis* in 1952, *Lymantria dispar* (L.) infested some 200 species of trees and low-growing plants in 1953, *Pristiphora erichsonii* (Htg.) damaged Japanese larch (*Larix leptolepis* (*kaempferi*)) severely in several years, and *Cinara todocola* (Inouye) caused severe injury to *A. sachalinensis* in ornamental plantings. Notes on the control measures applied are included.

Rui (D.). **Die Termitenherde in Venetien (Italien).** [Termite Infestation in Venetia (Italy).]—*Anz. Schädlingsk.* **29** pt. 1 pp. 1–2. Berlin, 1956.

It was discovered in September 1953 that about 50 houses in the district of Mira, in north-eastern Italy, were infested by *Reticulitermes lucifugus* (Rossi), and subsequent surveys showed that the termite was not only widespread in this district but also occurred near Verona and in Salzano and other places. Furniture and wooden doors, windows, and other parts of old houses were much damaged, and stocks of timber were also infested. Control was attempted by means of a solution of 4 per cent. malathion and 1 per cent. γ BHC in kerosene, which had proved effective elsewhere, but no success was obtained.

Schmutterer (H.). **Erfahrungen bei der Bekämpfung der Rübsenblattwespe *Athalia colibri* Christ (= *A. rosae* L.) mit Toxaphen, E 605, Systox und Metasystox.** [Experiments in the Control of *Athalia rosae* with Toxaphene, E 605, Systox and Metasystox.]—*Anz. Schädlingsk.* **29** pt. 5 pp. 68–70, 1 fig., 6 refs. Berlin, 1956.

Athalia rosae (L.) (*colibri* (Christ)) caused serious injury to white mustard (*Sinapis alba*) in an experimental field in western Germany in July 1955, and insecticides were tested for the control of the larvae. The following is based on the author's summary of the results. A spray of 0·5 per cent. toxaphene killed few larvae, but had considerable repellent effect and a second application at 0·2 per cent. gave some further protection, so that the plants were not completely defoliated. Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] at 0·05 per cent. and Metasystox [dimethyl 2-(ethylthio)ethyl phosphorothioate (methyl-demeton)] at 0·1 per cent. were not more effective, but 0·02 per cent. parathion (E 605) gave complete mortality in a day.

Thielmann (K.). **Control of the Nunne Moth in the Forest of Ebersberg. Report on the Use of DDT Fog.**—*World Crops* **8** no. 2 pp. 78–80, 1 fig. London, 1956.

A severe outbreak of *Lymantria monacha* (L.) began in 1952–53 near Munich, in the Ebersberg forest, which consists mainly of fir [*Abies*]. Since some 4,000 acres were threatened with complete or almost complete defoliation, treatment against the larvae was carried out in 1954 by means

of a thermal aerosol generator (TIFA) [*cf. R.A.E.*, A **35** 259]. A solution of 10 per cent. DDT was used in areas where the trees were sparse, and one of 20–25 per cent. where they were dense and heavily branched. All trees had low-hanging branches that hindered the movement of the fog, and penetration was obtained for distances of 50–200 yards, according to the density of the stand. In spite of unfavourable weather, treatment was completed between 28th May and 15th June, and protection of the treated area was good. Infestation continued in the remaining 8,000 acres of untreated forest and became more severe in 1955, and as natural enemies appeared unable to control the outbreak until the trees had been defoliated, a further campaign was envisaged.

PETERSEN (B. B.). ***Hylobius*-bekaempelse. Forsøg med DDT, parathion og blyarsenat.** [*Hylobius* Control. Tests with DDT, Parathion and Lead Arsenate.]—*Dansk Skovforen. Tidsskr.* **40** pt. 5 pp. 200–215, 4 figs., 4 refs. Copenhagen, 1955. (With a Summary in English.)

Tests were carried out in Denmark in 1954 on the use of insecticides to protect young spruce plants from attack by *Hylobius abietis* (L.). Very good results were given in several localities by spraying the young plants in April or May with 1 per cent. DDT or 0·2 per cent. parathion, both with an adhesive. Dipping the plants in the DDT liquid before planting was also effective, but lead arsenate in a spray or dip was much less satisfactory.

GORŸSHIN (N. I.). **On the photoperiodic Reaction in the Colorado Beetle *Leptinotarsa decemlineata* (Say).** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* **109** no. 1 pp. 205–208, 2 graphs, 6 refs. Moscow, 1956.

An account is given of laboratory investigations in the summer of 1954 on the effect of daily photoperiod, temperature and food quality on development and the occurrence of diapause in *Leptinotarsa decemlineata* (Say). In the first test, larvae and the resulting adults were kept in cages at 25°C. [77°F.] and exposed to daily photoperiods of 0–24 hours, fresh potato leaves being provided as food. The adults emerged between 10th and 15th August and all began feeding actively, but whereas almost all entered the soil in the cages by 30th August when the daily photoperiod was less than 16 hours, few did so when it was 17–18 hours and the others began reproducing in 5–7 days, oviposition continuing until late autumn. Only 34 per cent. of those exposed to a daily photoperiod of 16 hours entered the soil. As other factors were equal, the varying percentages of adults entering diapause are attributed to the differences in photoperiod, 16 hours being about the critical value. When the temperature was raised to 28°C. [82·4°F.] and the daily photoperiods were 16, 15 and 14 hours, the percentages of adults entering the soil were 9, 85 and 100, respectively, the critical length of the photoperiod becoming shorter at the higher temperature and the adults entering the soil more rapidly.

In further experiments, groups of larvae and the resulting adults were exposed to daily photoperiods of 12 or 18 hours, and leaves of potato, a hybrid of cultivated and wild potato, and *Solanum gibberulosum*, on which the mortality of the larvae was 10, 50 and 90–95 per cent., respectively, were provided as food. The results showed that the onset of diapause was regulated mainly by the length of the photoperiod, the quality of the food affecting only the length of the prediapause period.

The length of the photoperiod had no regular effect on the duration of the larval stage, which at 25°C. lasted 12·4, 11·6, 11·2, 12·8 and 11·8 days with photoperiods of 0, 15, 16, 17 and 24 hours, respectively. At 28°C.,

it varied from 9·2 to 9·6 days, and when the three different foods were provided, it ranged from 11–15 days, a much greater variation than that caused by photoperiod.

Vasil'ev (V. P.). **Pests of Fruit Plantations.** [*In Russian.*]—9 × 5¾ ins., 267 pp., 59 figs., 8½ pp. refs. Kiev, Akad. Nauk Ukr. SSR, Inst. Ent. Fitop., 1955. Price 10 *rub.* 55 *kop.*

Fruit cultivation is an important industry in the Ukraine. In the first part of this book, the author gives a list of 234 species of insects that damage fruit trees there, showing the trees attacked and the type of injury caused, and discusses the seasonal development and distribution of some 50 of the more important of these, giving maps for many of them, with indications of pest status. The second, much shorter, part contains recommendations for the control of individual pests, seasonal programmes of measures to be applied to fruit trees, and instructions on methods of assessing pest populations.

Coquard (—). **Utilisation du chauffage par infra-rouge pour la désinsectisation des semences de plantes tropicales.**—*Phytiat.-Phytopharm.* **4** no. 3 pp. 137–142, 1 graph, 3 refs. Paris, 1955.

The apparatus used in experiments on the control of stored-product pests by means of the heat induced by infra-red irradiation [*R.A.E.*, A **41** 233] was used in further experiments on *Stephanoderes hampei* (Ferr.) in coffee beans. The experimental technique is described, and the results are shown in tables. Complete mortality of larvae and adults was obtained when the internal temperature of the beans was raised to 74°C. [165·2°F.] for 13·5 seconds, these being the minimum effective conditions. It is pointed out that the moisture content of the beans was as high as 20 per cent., and as stored food products are normally drier than this, some reduction in the duration of treatment and consumption of energy would be possible in commercial application.

Gallego M. (F. L.). **El picudo o taladrador del plátano y del abacá *Cosmopolites sordidus* (Germar, 1824).** [The Weevil Borer of Banana and Manila Hemp, *C. sordidus.*]—*Rev. Fac. nac. Agron.* **18** no. 50 pp. 65–72, 3 figs., 5 refs. Medellín, 1956.

Cosmopolites sordidus (Germ.) was observed in Colombia for the first time in 1947, when it was found on banana at numerous places and on Manila hemp [*Musa textilis*] at one, but it is thought to have been long present. The American distribution of this weevil and its bionomics and control are reviewed.

Papers noticed by Title only.

Moutia (L. A.). **The commoner Insect Pests of Orchards, Food Crops, Vegetables, Flower Gardens and Household in Mauritius.**—*Bull. Dep. Agric. Mauritius* no. 91 [3+] iii + 79 pp., 13 pls. Port Louis, 1955. [Revision: *cf. R.A.E.*, A **32** 144, etc.]

Vappula (N. A.). **Finnish Entomological Literature published in 1954, including** [titles of papers on] **Economic Entomology and Control of Insect Pests.**—*Ann. ent. fenn.* **22** no. 4a 15 pp. Helsinki, 1956. [*Cf. R.A.E.*, A **44** 284.]

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